# NATURE

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# Planning for Constructive Defence

THE stress rightly been laid in recent months upon moral rearmament is essentially the recognition that there must be some underlying moral basis and explicit code of values upon which we can take our stand in working towards a more tolerable human society. In addition, however, we have been brought to realize the importance of visualizing the national economy and resources as a whole. The defence policy which is now imperative cannot be limited to the negative aspect of armaments and naval, military or air force organization. In addition, it must embrace positive effort devoted to removing causes of international friction and improving international relations, and also much of the work now directed to improving industrial efficiency, national health, social and economic conditions generally. It involves essentially industrial, social and economic strategy and tactics no less than naval or military strategy and tactics.

The dominant factor in determining this profound change has, of course, been the development of air transport as a weapon of war. In the face of this threat, the industrial cities of to-day have to develop the appropriate defensive measures in much the same way as the fortified city of the Middle Ages was developed to meet the military dangers of those days. The essential problem is indeed that of so planning our industrial, social and economic life as to secure adequate protection against sudden aggression, while preserving, under normal conditions, the maximum freedom of enterprise and activity consistent with rapid adjustment to the demands of a time of national emergency. We have to develop under the conditions of to-day a society that can mobilize in response to the threat of war as instantly and effectively as the burghers of the medieval town.

This aspect of planning was frankly recognized in the recent presidential address to the Town Planning Institute delivered by Mr. J. E. Acfield, who stressed the significance of the necessity of considering not only the risks of air attack but also those questions of location of industry, transport and the like which have to be taken into account in planning and may be equally determined by defence policy. He pointed out that the recent emergency had decisively emphasized the necessity for a National Advisory Board recommended in the report of the Town Planning Institute, and directed attention to the importance of recognizing trends in population occasioned not only by location of industry but also by changes in age distribution and the like due to the declining birth-rate. Similarly, a resolution on the planned control of the growth of London was moved by Sir Raymond Unwin at a conference of the Garden Cities and Town Planning Association. The resolution contemplates an authority which would control the location of new industries, preserve the remaining country within reach of London, guide development to existing smaller towns or well-designed new towns in the region and create a long-term plan for redevelopment in the centre. In discussing the project, Sir Raymond referred to the added urgency given to such problems by the necessity of protection from air raids, and the way in which planning could minimize risks.

The need for concerted policy in this matter of defence has been significantly enforced by investigations in widely different fields. Evidence submitted from time to time during the past year to the Royal Commission on the Distribution of the Industrial Population has indicated the necessity for some State control in this matter from the

point of view of the most effective utilization of national resources, no less than from considerations of defence, and the report when it appears may well be expected to make some emphatic pronouncement on this point. The appointment of this Commission itself was largely due to the recommendation of Sir Malcolm Stewart's third report as Commissioner of the Special Areas, that the further expansion of industry in Greater London should be controlled to secure a more even distribution of production in which the Special Areas might share.

The same point of view has been taken by Sir Malcolm's successor, Sir George Gillett, who in his first report* insists that consideration of the social as well as of the economic effects of the transference of industries lies near the root of the problem of the Special Areas. In his view, the Government cannot, especially since the introduction of tariffs and quotas, evade all responsibility for the location of industry. Social and strategic, as well as economic, causes are fast impelling the abandonment of the *laissez-faire* doctrine in this matter.

Even more emphatically, however, have the events of the recent national emergency endorsed Sir Malcolm Stewart's argument about control of the location of industry in Greater London. The Committee on Evacuation was appointed in May 1938, but the report itself was only published in November†, when the state of emergency was over. No reader of this report can be in any doubt as to the desirability of planning industrial location in future so as to diminish its vulnerability, or of the dangers to which unrestricted development in the past has now exposed us.

The difficulties with which evacuation is attended are made perfectly plain by the Committee, which considers that, none the less, the whole issue in any future war may well turn on the manner in which the problem of evacuation from densely populated areas is handled. Evacuation plans are no substitute for measures of active and passive defence, designed to enable production to be maintained in time of war in the industrial areas, but some measure of evacuation of non-essential persons from the principal industrial areas must be faced both on the grounds of humanity and to relieve the situation in congested industrial areas. Indeed the country will not be fully prepared against attack until the necessary organization has been established and schemes of evacuation worked out.

In a covering memorandum to the report, the Home Secretary, Sir Samuel Hoare, indicates the Government's approval of the recommendations of the Committee and particularly its concurrence in the principle of voluntary but organized evacuation, as well as in that of accommodation of refugees under powers of compulsory billeting. While, however, the report clearly shows that a scheme based on these lines is perfectly practicable and that adequate transport facilities appear to exist, on many points of detail very much remains to be done, particularly in regard to billeting, if the anomalies and even absurdities exposed during the crisis of September last are to be avoided. Something more than a mere count of houses or population is required if billeting is not to become farcical or even have alarming repercussions on the health of the community. Again, evacuation can only be regarded as a palliative, and the recognition of its present necessity should stimulate efforts directed to eliminate that necessity in future, whether by wiser location of industry or by the planning of towns and industrial areas so as to render them less vulnerable.

It should not be forgotten, moreover, that evacuation plans cannot be drawn up in isolation. They must form part of a considered and co-ordinated plan for national defence. Unless, for example, plans conceived in peace-time take into account the probable effect of emergency demands upon the population, not merely of the areas to be evacuated but also of those into which evacuation is to take place, the whole plan may break down at important points, or place intolerable strain upon particular localities or communities. Evacuation, in fact, must be considered with the Government's plan for a national register, whether voluntary or otherwise, which undoubtedly should yield important evidence to test the soundness of the evacuation plans in regard to district details. Moreover, man-power policy must involve more than the institution of a system even for securing the best utilization of the available resources in special skill and training or professional and technical knowledge. It must also have regard to measures which will ensure the continuance of the supply and that its quality is maintained.

From whatever angle therefore this question of national defence is approached, the supreme

* Report of the Commissioner for the Special Areas in England and Wales for the Year ended 30th September, 1937. (Cmd. 5593.) Pp. xii+209. (London: H.M. Stationery Office, 1938.) 3*s.* 6*d.* net.

† Report of the Committee on Evacuation: with a Covering Memorandum by the Secretary of State for the Home Department. (Cmd. 5837.) Pp. iv+39. (London: H.M. Stationery Office, 1938.) 9*s.* net.

importance of a definite and co-ordinated national policy which takes account of all the factors involved and transcends sectional interests or prejudiced views is unmistakable. The danger at the present moment is that the impulse towards effective planning provided by the recent emergency may die out before it has been turned to tangible purpose. Further, in the absence of the elaboration and enactment of a definite policy of defence, private or sectional interests may embark on courses or policies which are inconsistent with the public good; while public authorities left without adequate guidance, whether they do nothing but continue along existing lines or follow some unsatisfactory line, may increase unwittingly the obstacles to the execution of a boldly conceived national plan.

In the face of this complex and difficult situation with its urgent call for a national plan, the opportunity which a defence policy affords for constructive effort should not be overlooked. National defence has qualitative as well as quantitative aspects. It must not merely provide against external threats to the existence of the nation. It must make positive contributions to its welfare. A policy for defence must take account of social welfare as well as of armament production and civil defence. National fitness in the widest sense is an indispensable element in national defence. Wisely conceived, a policy for defence will take account not only of physical training, nutrition, overcrowding, unemployment and other factors affecting the health of the nation. It will have regard also to many of the amenities of life which determine the mental and moral as well as the physical fitness of the people. Planning, whether civic or industrial, must be conceived not merely to provide more effective protection against attack and more efficient use of the man-power and material resources of the nation, but also to preserve the amenities of countryside, flora and fauna. It involves a land policy which will safeguard no less against the blunders of the past which have increased vulnerability than against the further destruction of national assets and amenities. It may well involve, too, an examination of the functions of local government and national administration and of the size of operating areas, if causes of inefficiency are to be eliminated and obstacles to a national policy overcome.

Nothing would indeed be more short-sighted than a policy for defence which restricted or warped educational development or those ideals of individual freedom of thought and criticism which are rightly cherished in a democracy. A defence policy must appeal to the highest ideals if it is to claim support, and for this reason alone it will be inadequate unless it offers also constructive effort towards international peace and good will, by working towards the removal of causes of international friction. Here indeed is work for education both within and without the frontiers of a State. The development of a national defence policy on such lines under the stress of the recent emergency may give us the stimulus to a plan and a concentrated effort which will overcome alike the obstacles and the threats which sectional or private interests have so long opposed in such diverse fields as road transport, building, town planning, national parks, nutrition and health to measures the desirability of which in the national interest has long been beyond dispute.

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# British Agriculture

**British Agriculture:** the Principles of Future Policy. A Report of an Enquiry organized by Viscount Astor and B. Seebohm Rowntree. Pp. xx+469. (London, New York and Toronto: Longmans, Green and Co., Ltd., 1938.) 15*s*. net.

THIS book is the report of an inquiry, organized by Viscount Astor and Mr. Seebohm Rowntree, into the economic structure of British agriculture. It deals comprehensively with the main aspects of the agricultural problem, and although its chapters are rather unequal in quality, it provides a valuable addition to agricultural literature.

The volume is divided into five parts. In the first of these the authors examine the possibility of increasing agricultural production by curtailing imports. After considering the issues involved, they consider that protective measures should be limited so far as possible to securing reasonable stability for home producers and to averting

disastrous price fluctuations. In their opinion the future development of the industry should depend on increased production of 'health foods', such as milk and vegetables, for which farmers in Great Britain enjoy natural protection. They also consider that the industry should be assisted by the State in ways likely to promote the supply of these foods, to increase efficiency in both production and marketing, and to preserve the fertility of the soil. They then examine the economic causes underlying the changes which have occurred in agricultural production in Great Britain during recent years.

Part 2 discusses in detail the economics of crop production, and contains chapters on grass, grain crops, roots and sugar policy, feeding stuffs, potatoes and hops, vegetables and fruit. Part 3 is concerned with livestock and livestock products. In this section there are chapters on cattle, sheep, pigs, poultry, milk production, and milk marketing. Part 4 deals with the personnel and organization of the industry, and discusses the problems of agricultural labour, smallholders, farmers, agricultural credit, landlords, and research, education and advice. Each of these chapters is packed with interesting information, although sometimes they are marred by wrong emphasis and factual inaccuracies.

In this respect, the chapter on milk is particularly unfortunate. For example, the effects of depreciation on milk production costs are considerably exaggerated, and the question of increasing the herd life of the cow, on which great emphasis is placed, is less important than that of increasing its general health. Of course the first condition is likely to follow from the second ; but, owing to the more rigorous selection necessary in an attested herd, it is improbable that depreciation will be reduced, at least in the early stages of a cleaning-up policy. Moreover, depreciation at the moment represents only some 10 per cent of the total costs of milk production, or 1*d.* per gallon of milk produced. Again, there is no sound evidence to suggest that in ordinary farming practice high herd mortality is positively correlated with high yields. In fact the Cambridge investigation quoted in the report indicated that there was little difference in wastage between high- and low-yielding herds.

Further, when the authors state that there has been over-much propaganda in favour of high yields, it must be remembered that the yield of 3·5 gallons per day, or nearly 1,300 gallons in the year, at which they claim the dairyman obtains highest economic efficiency, is reached by comparatively few cows, while more than half the herds in Great Britain have an average yield of less than half that amount. In practice, therefore, the choice is not between yields of, say, 1,300–1,500 gallons but probably between yields of 600–800 gallons. It would also be difficult to substantiate the statement that, on the average, milk yields fall by two-thirds following an outbreak of contagious abortion, while it is surely incorrect to measure the trend in yield per cow by two sets of figures so different as the agricultural returns for 1908 and the Oxford Report on Milk Production Costs for 1938.

Part 5 contains the conclusions. Stated briefly, these are as follows. As the State, through its system of social services, accepts responsibility for the education and health of the people, so also should it accept responsibility for their nutrition. A policy of improved nutrition would enable a large increase in the production of health-protective foods, and particularly of milk, to be undertaken by the British farmer. The milk industry would, in fact, form the central feature of the suggested new policy.

The report recommends that the milk industry be removed from producer control, and organized in some form of public utility ; that retail prices should be decontrolled, and that steps should be taken to improve methods of production and distribution. The authors also emphasize the need for propaganda to increase consumption, and the continuation and increase of subsidies from the State in order to supply milk to special categories of consumers. They have been impressed by the increasing inability of landlords to supply the industry with long-term credit, and in consequence recommend the formation of regional land improvement commissions empowered to buy agricultural land requiring long-term capital improvement. By this method the State would gradually extend its function as landowner and would be in a position to influence the evolution of agricultural holdings in directions which seemed desirable.

Emphasis is also laid on the need for schemes of livestock and crop improvement, for agricultural research, and for improved social conditions in rural areas. The authors recognize the necessity of subsidizing British agriculture, but they prefer, and rightly, that the principle of comparative advantage should be adopted within the framework of State subsidies, and that public money should be spent on the production of commodities which will most benefit the community as a whole. They also believe that any form of price guarantee should be designed to limit loss rather than to ensure profit.

Although many of their conclusions are likely to prove unpopular with the farming community of Great Britain, the authors are to be congratulated on their courageous handling of a very complex problem.

# Advances in Analytical Chemistry

(1) Qualitative Analysis by Spot Tests: Inorganic and Organic Applications. By Prof. Fritz Feigl. Translated from the latest German edition by Dr. Janet W. Matthews. Pp. ix + 400. (Amsterdam: Nordemann Publishing Co.; London: Crosby Lockwood and Son, Ltd., 1937.) 30*s*.

(2) Mikroanalytische Nachweise anorganischer Ionen: Ausführung und Reaktionsbilder. Zusammengestellt von Gerhard Kramer. Pp. viii + 36 + 8 plates. (Leipzig: Akademische Verlagsgesellschaft m.b.H., 1937). 5.60 gold marks.

(3) The Analytical Chemistry of Tantalum and Niobium: the Analysis of their Minerals and the Application of Tannin in Gravimetric Analysis. By Dr. W. R. Schoeller. (Published under the auspices of the Society of Public Analysts and Other Analytical Chemists). Pp. xvi + 198. (London: Chapman and Hall, Ltd., 1937.) 21*s*. net.

(4) Quantitative Analysis: By Prof. W. C. Pierce and Prof. E. L. Haenisch. Pp. xi + 412. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1937.) 15*s*. net.

(1) ALTHOUGH 'spot' methods of analysis are beginning to find their way into textbooks, yet Prof. Feigl's treatise is still the standard work on the subject, and by far the most complete exposition of it. Consequently, it is a matter for congratulation that the practical section of the latest (1935) edition (reviewed in NATURE, **136**, 89; 1935), has been translated into English. The theoretical portion is to be published separately in the future. This English edition is, in some measure, an advance on the original, for it has been brought up to date both by revision and by the inclusion of the most recent work of the author and his collaborators. The majority of these new tests relate to the detection of organic compounds or groups, so that this section now covers a wide field.

Dr. Matthews has succeeded admirably in her role as translator, and one would scarcely have detected that it was a translation but for the use that is made of certain German forms, such as iron (III) chloride instead of our ferric chloride, and that the various publications cited are abbreviated as in the *Chemische Zentralblatt*. The text contains a number of errors and misprints, some of which have been carried over from the original, while others have been introduced during translation. Fortunately, it is only occasionally that mistakes are found in the actual description of the methods of carrying out the tests, and these are fairly easily detected from the accompanying discussion or from the lists of reagents.

The simplicity of 'spot' tests and the ever-widening range of their usefulness are such as to render this treatise worthy of study by all English-speaking investigators who have anything to do with chemical analysis.

(2) Dealing also with qualitative micro-analysis, this little volume describes tests which are suitable for carrying out with the aid of a microscope. The author has confined himself to the detection of the more common ions, and has chosen reactions that give rise to crystalline forms easily detected or having distinctive colours. He has carefully described the best method of performing these tests in order to secure definite results, but, for this purpose, he has employed pure chemicals and, in many cases, in given concentrations; whether such favourable results are obtainable under the variable conditions to be expected in ordinary analytical work is doubtful.

The tests described by the author are carried out after the usual group separations have been made and, even so, many of them require further separations inside the groups. Thus cadmium is identified either as oxalate or as the double chloride with rubidium chloride: in each case a prior removal of copper is necessary. Similarly, antimony must be separated from arsenic, manganese from zinc, nickel from cobalt and calcium from strontium. The tests are, therefore, mostly confirmatory ones, and are neither so specific nor so elegant as those carried out on filter paper or spotting plates. Nevertheless, there is great scope for the use of the microscope in qualitative analysis, and this monograph, which is well illustrated with many photomicrographs, will serve as a useful introduction to what can be a most fascinating study.

(3) The quantitative separation of tantalum and niobium has been attempted by many chemists during the past hundred years, but it is only recently that Dr. Schoeller and his co-workers have succeeded in achieving acceptable results. The monograph under review describes the methods they have adopted, not only in estimating these elements in the presence of each other, but

also in effecting separations from other metals, particularly those which occur in mineral association with them. The difficulties of the problem have been due partly to the chemical similarity of niobium and tantalum but more particularly to the ease with which their hydroxides, as well as those of certain other earths, can lose their specific behaviour when in admixture, by adopting the properties of the major constituent of that mixture. This phenomenon is attributed by the author to the structural similarity of the hydrated oxides when produced by hydrolytic precipitation, so that the primary sol particles of the colloidal precipitate are heterogeneous, being formed in a manner not unlike that of a mixed crystal.

The volume is well produced and excellently written. The various methods are clearly and concisely described and are illustrated by numerous tables indicating the results obtained by the author in the different separations. There are also interesting chapters on those compounds of tantalum and niobium which are analytically important, on the chemical composition of minerals containing earth-acids and on the use of tannin in other analytical investigations. In addition, there is a section on the qualitative analysis of these metals, and a summary of the original papers on which the text of the monograph is based.

(4) This text-book, although compiled for first-year university students, covers a wide field, while some of the theoretical matter is quite advanced. The work is divided into four sections, the first of which deals with the usual fundamental principles, the use of the balance and the errors and precision of chemical analysis. The second part deals with volumetric analysis, this being treated at some length and in a very comprehensive manner. The different procedures are simply and clearly described, while often there are appended notes which connect theory with practice or emphasize the precautions that must be observed.

The part on gravimetric analysis, introduced by an excellent chapter on the theory of precipitation, contains comparatively few exercises, the intention of the authors being to illustrate the various types of methods rather than to provide schemes for the analysis of many elements. This section concludes with a description of the complete analysis of limestone. Part 4 deals briefly with special methods such as electrodeposition, electrometric titrations, colorimetry and the use of physical methods in analysis. There are the usual tables, while the text is also liberally besprinkled with questions and problems. Like many other American publications, it is excellently printed and attractively bound.

G. R. D.

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# Exploring in Central Asia

## The Silk Road

By Sven Hedin. Translated from the Swedish by F. H. Lyon. Pp. viii+322+31 plates. (London: George Routledge and Sons, Ltd., 1938.) 18*s*. net.

IN 1935, towards the end of the journey chronicled in this volume, Dr. Sven Hedin marked the fiftieth anniversary of his departure on his first journey in Asia, to the exploration of which he has devoted his whole life. In congratulating him on the unimpaired energy and courage which enabled him to endure the hardships and dangers of Sinkiang in a state of civil war, we add our felicitations on the confidence and respect for his character and achievement shown by the Chinese, notoriously suspicious of foreign men of science, which induced their Government to entrust him with a mission of, to them, signal importance.

The expedition into Sinkiang here recorded started in the autumn of 1933. It was the outcome of certain suggestions made by the author in relation to the position in Sinkiang, the last remaining of the outlying provinces of the Chinese Empire. In consequence, he was invited by the Chinese Government at Nanking to plan and survey motor roads into the heart of Sinkiang across the Gobi Desert, one of the measures he had suggested to preserve and consolidate the influence of the Chinese Government in the province.

Dr. Hedin's decision as to the most suitable route fell upon the old Imperial road across the Central Asiatic tract, the so-called "Silk Road"—the title apparently is modern, and due to von Richthofen—which had been first traversed more than two thousand years ago, and in its total length of six thousand miles from China to Tyre, had been, as the author puts it, "from a cultural-historical standpoint the most significant connecting link between peoples and continents that has ever existed on earth". By adopting this route it was calculated that a journey to Urumchi, which took a caravan three months, could be accomplished in ten to twelve days.

Of the author's adventurous journeys, this latest was the most dangerous and nerve-racking. The outward journey to Etsin-göl was not without its incidents; but although they caused delay, and also anxiety, they were such as might be expected to happen on a journey by car and lorry

in early winter over rough tracks and frozen rivers. When, however, the party crossed into Sinkiang, which, so far as they had been able to ascertain, was reported 'quiet', they found themselves involved in the struggles of two opposing forces, of which one, that of the Mahommedan Tungan leader, was at the point of defeat. They were imprisoned by both forces in turn, and came within even less than the proverbial hair's breadth of being shot. They were detained so long at Urumchi, the turning point of their journey, that an expedition, which had been planned to take eight months, was prolonged to eighteen. The return from Urumchi, including time which was spent in surveying the "Silk Road" and at other necessary halts on the way, occupied only fifty-three days.

Dr. Hedin describes the outward and return journeys with his customary attention to relevant detail, but his reflections on the general situation, illuminating in their bearing on its development since his book was first published in Sweden in 1936, tend to overshadow the interest of his topography. In view of the Russian economic and political predominance in the province, the author thinks that Sinkiang will be the field of the struggle between Russia and Japan for predominance in the East. China, which has endured for four thousand years without any outstanding military achievement, will, he holds, survive present trials.

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# An Exposition of Marxism

The Marxist Philosophy and the Sciences
By Prof. J. B. S. Haldane. Pp. 183. (London: George Allen and Unwin, Ltd., 1938.) 5*s*. net.

PROF. J. B. S. HALDANE is, by his own confession, a recent convert to the philosophy of Marx, and with the characteristic zeal of the convert wishes others to share his faith. If it is necessary or useful for scientific workers to have an explicit philosophy, Marxism is certainly more stimulating than the various brands of positivism that have been popular. It does at least suggest that scientific knowledge is important. Prof. Haldane begins with a brief general sketch of Marxism. He then discusses a number of present-day problems, mathematical, physical, biological and sociological, on this basis. He quotes a number of excellent comments that were made by Engels on the science of his day and are still relevant and illuminating.

As usual, Prof. Haldane displays an astonishing encyclopædic knowledge of science, and is interesting and lucid—except for one point. He does not succeed in dispelling the fog that surrounds the uses of the term 'dialectic'. The mildest use seems only to imply that in any complex system of things, people, or thoughts, opposing forces or tendencies are at work, so that processes are likely to oscillate first one way then another between extremes. The fiercest use seems to mean that Marxist opinion is always right, even if it is wrong, because it is dialectical, and everyone else's always wrong, even if it is right, because it is not dialectical.

Hegel's dialectic, taken as a description of the psychology of thinking in terms of a Heraclitean 'strife of opposites', is not without value. As a statement of what is logically valid for thought it rests upon a misuse of such terms as 'contradiction' and 'negation' and therefore is confused, if not entirely wrong. Hegel tried to display the universe as a product of thought and this was, as many suppose, a fatal error. Marx tried to correct the error by inverting the Hegelian method. He treated thought as a product of human activity within a universe that is in itself other than thought. This may be an improvement: but he took over the Hegelian dialectic, inverted but retaining its inherent confusions. Heraclitus, who lived before logic had been invented, may be pardoned for stating his doctrine of 'the strife of opposites' without regard for logical rules, but his modern followers ought not to claim so much licence. In particular, the advocates of dialectic ought not to use the logical fact that every proposition has one contradictory and one only, to infer that in any situation there can be only two opposed tendencies or processes, whereas there may be many. The doctrine that the course of human history can be predicted rests on this assumption, and might be true if it were valid. In some instances the assumption may be harmless, but it is at best an over-simplification and a hindrance to clear thinking. Another source of difficulty is the notion that double negation has some mysterious virtue unknown to strict logic.

This is perhaps less a review of Prof. Haldane's book than an attack on dialectic. But while its dialectical confusions remain, the Marxist philosophy can scarcely be as helpful to scientific workers, or anyone, as the author would wish it to be. Possibly he is the man to put them right.

A. D. R.

**A Catalogue of the Ammonites of the Liassic Family Liparoceratidæ in the British Museum (Natural History)**

By Dr. L. F. Spath. Pp. ix + 192 + 26 plates. (London: British Museum (Natural History), 1938.) 30*s*.

THIS work has a much wider significance than might be inferred from the fact that it deals with only one family of ammonites, and that a comparatively short-lived one. Unlike most writers on ammonites, the author attaches but little importance to phylogeny which is based on the evidence of ontogeny. Previous work on the family Liparoceratidæ has been done by Hyatt, Buckman, and Trueman, and their conclusions rest mainly on the assumption that the phylogeny of an ammonite may be seen in its ontogeny. According to these authors, the evolute capricorn Liparoceratids were ancestral and gave rise, through the dimorphs, to the involute sphærocones.

In the view now put forward by Spath this order of evolution is entirely reversed. He maintains that the more or less involute (closely coiled), often sphærocone, Liparoceratids are ancestral to the more evolute (dimorph) forms, and that these in turn gave rise to the capricorns, which are the most evolute Liparoceratids. This order of evolution is borne out by the stratigraphical succession which, owing largely to the work of Dr. W. D. Lang, is now known in much greater detail than hitherto, and shows that there are no capricorns among the early Liparoceratids.

In his systematic and phylogenetic work, Spath relies mainly on resemblances in the characters of the adolescent and adult stages, on the existence of passage forms, and particularly on the order of appearance in time of different ammonites. He considers that the value of small differences in the suture line has been greatly over-rated; that the position of the siphuncle in the early stages of development is too variable to be of importance; and that too much stress has been laid on the configuration of the earliest whorls. He shows that new characters often appeared in the younger stages of development, and, as evolution proceeded, spread to later whorls.

The numerous and excellent illustrations will enable readers to follow in some detail the author's views on the evolution of the Liparoceratidæ, and the glossary of technical terms will be of value to those who have not made a special study of this group of fossils.

**Fernsehen:**

die neuere Entwicklung insbesondere der deutschen Fernsehtechnik. Vorträge von M. von Ardenne, Dr. F. Banneitz, Dr. E. Brüche, W. Buschbeck, Prof. Dr. A. Karolus, Dr. M. Knoll, Dr. R. Möller, Prof. Dr. F. Schröter. Herausgegeben von Prof. Dr. Fritz Schröter. Pp. vi + 260. (Berlin: Julius Springer, 1937.) 21 gold marks.

IN the autumn of 1936 the German Society of Electrical Engineers (Elektrotechnischer Verein) and the German Post Office arranged a course of lectures on television at the Technische Hochschule, Berlin. These lectures were intended to give to a technical audience an introductory survey.

The present book is based on this course and contains the contributions of the various lecturers (most of them well-known specialists in their subjects) in abstracted form. The book covers the ground very well. It deals not only with the electron optical systems of television, but devotes also adequate space to the mechanical systems. It pays special attention to the problem of transmitting television signals by radio or by cable and also contains a chapter on large-screen television.

The treatment of the subject by the various contributors is as a rule clear, though naturally concise; and the essential points are well brought out. The only notable exception is the discussion of the optical efficiency of mechanical scanners, where some vague statements are made.

The book is a valuable addition to the few existing text-books on the subject, though its main use to English workers will be as an account of German tendencies and the state of development reached by the end of 1936. A. B.

**The Principles of Soil Science**

By Prof. Alexius A. J. de Sigmond. Translated from the Hungarian by Prof. Arthur B. Yolland; translation edited by G. V. Jacks. Pp. xiv + 362 + 4 plates. (London: Thomas Murby and Co., 1938.) 22*s*. 6*d*. net.

PROF. DE SIGMOND'S "Altálanos Talajtan" has been translated into English and adapted by omitting the sections on soil physics and microbiology from the agronomy section, and other material of only local interest.

Part 1 deals with soil genetics. The chemical composition of rock-forming minerals is not given, the author stressing the point that it is the chemically weathered part that is of particular significance in soil formation and the development of soil character. The relative influence of soil-forming factors is fully discussed and the effect of climate on soil development well portrayed. In the agronomy section the chemical properties of soils are described and their method of presentation leads logically to the system of classification adopted.

The main section of the book—soil systematics—is treated from a novel aspect, as the classification is based on the results of leaching experiments. It is fully comprehensive, is based on the characteristics of the soil and in addition is claimed to depict the genetic and dynamic character of the soil. Twenty-five soil orders are described and each is subdivided into main types of which the eight in soil order XI largely cover the range of useful soils.

Part 4—cartography—contains useful suggestions for the mapping of small areas and the dissemination of useful advice to farmers in the form of practical soil maps showing one variant each, for example, need for lime, *p*H values, manurial requirements, etc. Four well-produced plates are included in an appendix to this section. J. W. B.

# Physics and the Physicists of the Eighteen Seventies*

By Sir Ambrose Fleming, F.R.S.

IN 1874 the Physical Society of London was founded by a well-known physicist, Prof. Frederick Guthrie. The first meeting of the Society was held on March 21, 1874, in Guthrie's lecture room in the Science Schools, South Kensington, and by his great kindness I had the privilege of reading the first paper to the members, the subject being "The New Contact Theory of the Galvanic Cell".

Let us then take a glance backward at the state of physics in the years 1870–1880, and the men who were foremost in advancing it. We may divide them into two broad classes. There were first a few who were highly competent mathematicians and conformed to the model of Newton in being able not only to wield the powerful weapon of mathematical analysis but also were competent experimentalists. In Great Britain at that time this class was chiefly represented by Sir George Stokes, Lucasian professor of mathematics in the University of Cambridge, by Sir William Thomson, who had held the chair of natural philosophy in the University of Glasgow since the time when he was twenty-two years of age, and by his enormous knowledge, brilliant experimental researches and practical inventions held a foremost place in universal opinion as a physicist. Then next by James Clerk Maxwell, who, even as an undergraduate, had made notable contributions to mathematics and physics. He had translated Faraday's physical conceptions into mathematical language, explored the phenomena of colour, laid firm the foundations of the kinetic theory of gases and made important measurements of the viscosity of air. He had held professorships of natural philosophy at Aberdeen and King's College, London. In 1865 he had resigned this latter appointment and retired to his Scottish estate at Glenlair to engage in writing his great treatise on "Electricity and Magnetism".

Peter Guthrie Tait was then professor of physics in the University of Edinburgh. As a mathematician he had inherited the mantle of Sir W. R. Hamilton, the inventor of quaternians, but Tait also made many very important contributions to experimental physics. Then in the same rank of great mathematical physicists, we had in Germany Helmholtz and Kirchhoff; in France, Cornu, and in the United States, Willard Gibbs. On the other hand, there were many eminent physicists who, like Faraday, had not much mathematical knowledge, but attained their results purely by experimental work. Among these in the eighteen seventies, John Tyndall was one of the most popular. He had very great abilities as an exponent of science. J. P. Joule had made the most valuable contributions to physical measurements by his proof of the so-called Joule's law in electricity and in his determinations of the mechanical equivalent of heat. A reprint of Joule's scientific papers was issued by the Physical Society in 1884.

Very prominent in this group was William Crookes. He had, like many of the experimental physicists, begun as a chemist. Crookes discovered by spectrum analysis the element thallium, and had isolated the metal and determined its atomic weight. Crookes had then turned to research on electrical discharge in high vacua. He had improved methods of vacuum technique and had rediscovered many important facts concerning electric discharge in high vacua noticed by Hittorf, Puluj and others. Finally he devised the light-mill or radiometer.

Another of this group was J. H. Gladstone, the first president of the Physical Society, and he also was first of all a chemist and latterly an experimental physicist. His work on refractive indices was of special importance. Neither must we omit to mention in this group the name of Frederick Guthrie, who made several very important additions to physical knowledge. Other experimental physicists of that date were R. B. Clifton at Oxford, W. Grylls Adams and G. Carey Foster in London, Balfour Stewart in Manchester. Prior to about 1866, there were in Great Britain scarcely any laboratories properly equipped for research or teaching in physics.

The necessity for quantitative work, especially in electricity, had been emphasized by the technical advances in telegraphy. In 1856, a far-seeing man, Cyrus Field, had conceived the idea of a trans-Atlantic submarine cable to unite Great Britain and the United States, and had formed a company in 1856 to undertake it. But the question at once presented itself whether signals could be sent through such a long cable quickly enough to enable a sufficient income to be earned to pay the interest on capital and also the working expenses. Faraday had been consulted, and pointed out that such a submarine cable was a large condenser or Leyden jar, but he thought signals might be sent through it sufficiently quickly to make it pay.

* From an address delivered before the Physical Society on January 13.

Here we see the immense power of mathematical analysis guided by correct physical ideas. In 1855 William Thomson, then a young professor, sent a paper on the theory of the electric telegraph to the Royal Society. Assuming the cable to have certain resistance and also electrostatic capacity per mile, he proved that when a steady electromotive force was applied at one end the outcoming current at the other rose up gradually according to a certain curve of arrival. The time taken to reach a certain current strength was directly proportional to the square of the length of the cable and directly as the product of the resistance and capacity per mile of the cable. This showed that the right method for signalling was to have as sensitive a detector as possible at the receiving end and to use the lowest possible applied electromotive force at the sending end. Thomson had meanwhile invented and made his sensitive mirror galvanometer for cable signalling.

By 1865, three Atlantic cables had been laid and lost. But in 1866 success finally crowned the efforts of the promoters and a fourth cable was made and laid and the 1865 cable raised and repaired. Thus two complete Atlantic cables effected communication between England and the United States, which were worked with Thomson's instruments. In 1870, Thomson invented his remarkable syphon recorder to receive and print cable messages, and this has remained to this day the standard instrument for all cable reception.

Thus the year 1870 saw the practical achievement of submarine telegraphy accomplished and the invention of the instruments needed for working. From that time the making and laying of submarine cables became a particularly British industry.

But the same year (1870) witnessed another event of great importance with regard to physical research, namely, the founding of the Cavendish Laboratory at Cambridge. Although some attempts had been made to foster physical research there, the University was without means to provide for it. In October 1870, the seventh Duke of Devonshire, then Chancellor of the University of Cambridge, sent a letter to the Vice-Chancellor offering to defray the cost of erecting and equipping a physical laboratory in the University. This munificent offer was gratefully accepted. In March 1871, Maxwell was elected as the first Cavendish professor of physics. The building of the Laboratory was completed early in 1874. A year before, in 1873, Maxwell had published his great treatise on "Electricity and Magnetism", and physicists everywhere were trying to master the new ideas he had introduced into the subject. He had embodied in it his earlier work of expressing in mathematical language Faraday's ideas of lines of electric and magnetic force and of the dielectric as the true seat of the energy involved. He had also included in the second volume a reproduction and exposition of his great paper sent to the Royal Society in 1864 on "A Dynamical Theory of the Electromagnetic Field". In this paper he had shown that electric and magnetic effects are propagated through space with a velocity equal to that of light in the medium and had foretold the existence of the electromagnetic waves now utilized to give us radio-telegraphy and telephony.

After Maxwell's death in 1879, I remember that an eminent mathematician, Sir W. D. Niven, said to me that he regarded this paper with its wonderful originality and power to be one of the greatest productions of the human mind.

In his introductory lecture given by Maxwell in October 1871 on his installation as Cavendish professor, he had expressed his ideas of the aim and functions of the Laboratory. He did not contemplate its main use to be that of training undergraduate students in the repetition of experiments described in text-books, but that its principal object should be quantitative measurements and the production of new knowledge by research by post-graduate or other students. Very magnificently has this ideal been held in view by Maxwell's successors in the chair.

Another event in the year 1870 which had an influence on physical research was the taking over by the State of the telegraph system in Great Britain. Up to that time, land telegraphy had been conducted by several public companies each with its special area of operations. This of course greatly limited the use of the electric telegraph.

The Government of that day passed Acts of Parliament in 1868 and 1869 entitling it to buy out, take over, and place under the General Post Office all telegraphic work in Great Britain. At the same time, it was greatly extended and the country overlaid with a network of telegraphic wires enabling communications to be made between all places where there was a post office. This called for the production of practical standards of the electrical units such as the ohm, the volt, the ampere, the farad, and accurate methods of electrical measurement. A British Association Committee had constructed a number of coils of wire of various alloys the resistance of each of which was asserted to be at certain marked temperatures equal to $10^9$ absolute units of resistance on the electromagnetic system. These had been deposited in the Cavendish Laboratory.

When I went up to Cambridge in October 1877 to work in the Cavendish Laboratory, Maxwell suggested to me to undertake the work of comparing these coils and ascertaining from them their resistances at certain temperatures and hence the most probable value of the B.A. Unit.

For this purpose I devised a special form of Wheatstone's bridge which was described to the Physical Society in 1880. I prepared, as the result of about two years work, a chart showing the variation of resistance with temperature of each of the coils. The true absolute values of these were determined later on (after Maxwell's early lamented death in November 1879) by Lord Rayleigh, who was Cavendish professor until 1884. This B.A. Unit proved to have an electrical resistance of $0{\cdot}9867 \times 10^9$ centimetres per second or less than a true ohm of $10^9$ cm./sec.

Part of Maxwell's work during the last years of his life comprised the editing for publication of the unpublished electrical researches of the Hon. Henry Cavendish (1731–1810). Cavendish was an experimentalist of great ingenuity, and with the most rudimentary apparatus carried out important researches. Maxwell repeated with similar apparatus all Cavendish's results. Among other things, Cavendish anticipated Faraday's discovery of specific inductive capacity and made researches to find out if the law of electrical attractions or repulsions varies in any sensible degree from the inverse square of the distance. Maxwell carefully repeated these with improved apparatus and found that the index deviated from 2 by not more than $\frac{1}{21,600}$ either way. Cavendish made measurements of the comparative electrical resistance of various materials by taking the shock of a Leyden jar through a certain length of each material and adjusting the lengths until the shocks were estimated to be about equally painful. Most of the workers in the laboratory were called upon at various times to act as 'shock meters' in Maxwell's repetition of Cavendish's experiments.

Maxwell's lecture experiments were always marked by great ingenuity, and he could give copious new information on even the most familiar scientific facts or discoveries. In conversation he was often difficult to understand by reason of a certain paradoxical and humorous mode of speech.

No mention of Maxwell's work would be complete without a brief reference to his other writings, written in the eighteen seventies. He published a treatise on the "Theory of Heat" which had all the characteristics of lucidity and novelty which marked his authorship. In it he gave the elements of the science of thermodynamics and the contributions to it made by Carnot, Clausius, Willard Gibbs, Rankine and W. Thomson. His other small book "Matter and Motion" was a delightfully interesting small treatise on dynamics. It was re-edited with some additions after Maxwell's death by Sir Joseph Larmor. In addition to this he wrote many articles for the ninth edition of the "Encyclopædia Britannica", and in 1873 gave a memorable lecture on "Molecules" to the British Association at Bradford, parts of which have been often quoted.

We must now return to consider the work of Sir W. Thomson (later Lord Kelvin) during the decade 1870–80 under consideration. He was at this time engaged in improving the mariner's compass. As a yachtsman and the owner of the *Lalla Rookh*, he took an extreme interest in all things connected with navigation, and left his improvements on everything. In 1874, he was asked to write an article on the magnetic compass for *Good Words* and at once took note of the defects of the then used type. Little by little he brought it to a state of perfection in which it was adopted all over the world. He gives a full account of it in the third volume of his popular "Lectures and Addresses". At the same time he vastly improved the method of deep-sea sounding by using steel pianoforte wire instead of hemp rope. The depth was measured by the degree to which the air in a glass tube open at the bottom but closed at the top was compressed when the sea floor was reached. In 1876 he made known his enormously ingenious machines for recording, analysing, and predicting the tides at any port, and in a lecture at Glasgow in 1875 he gave a most instructive account of methods of determining the position of a ship at sea by Sumner circles. His knowledge of everything connected with navigation, tides and waves was vast and accurate, and he touched nothing he did not elucidate and improve.

The decade we are considering was remarkable also for the completed invention of two important electrical appliances, namely, the speaking telephone and the incandescent electric lamp, the achievement of which had long been objects of physical research.

Without reference to early attempts, it is well known that Alexander Graham Bell was the first to produce a simple speaking telephone which was publicly exhibited in 1876 at the Philadelphia Exhibition. Sir W. Thomson saw and used it there and on return to England described it enthusiastically to an audience at the British Association meeting at Glasgow. Bell was actually engaged in trying to effect multiple telegraphy when he stumbled across the principle of his magneto-telephone.

The Bell telephone was a good receiver but poor transmitter. T. A. Edison had meanwhile invented his carbon button transmitter, in which the motions of a sound-actuated diaphragm compressed a button of lamp-black and varied its resistance and therefore the current in the circuit. D. E. Hughes, the inventor of a printing telegraph, then came into the field in 1878 with his discovery of the effects of slight pressure on a loose contact between two pieces of graphitic-carbon. This in time gave

us the modern microphone transmitter. Bell had suggested meanwhile the idea of a telephone exchange, and the Edison and Bell interests in England had to unite to provide the most effective transmitter and receiver.

The problem of incandescent electric lighting had occupied attention for thirty years or more in the endeavour to provide a small unit of light for domestic illumination. J. W. Swan solved the problem early in 1880 of producing a carbon filament by carbonizing a cotton thread which had been parchmentized by sulphuric acid and mounting a loop of this carbon filament in a glass bulb exhausted of its air. Edison about the same time carbonized slender filaments of bamboo in horse-shoe shape and also produced an effective carbon filament lamp.

The early lamps gave a light of about sixteen candles at a power expenditure of about sixty-four watts. From that date electric illumination by incandescent lamps became practicable.

In conclusion, it may be useful to attempt to sum up briefly the achievements in physics during the decade 1870–1880. Broadly speaking, it was an age of practical invention in which well-ascertained scientific principles were applied in some way to create new industries or useful arts. In telegraphy there were many very important additions. Wheatstone automatic, quadruplex and high-speed printing telegraphs came into use. The speaking telephone and telephone exchanges added to the convenience of life. Electric incandescent lamps and the invention of the dynamo had made possible public electric supply stations and domestic electric illumination.

In 1873 the reversibility of the dynamo was discovered; that is, that it could act as a motor when current was put into it, and some degree of progress had been made in the use of electric motors and possible electric transmission of power.

In relation to physical theories, the period we are considering was essentially mechanistic and deterministic in ideas. The conception of a universal ether having elasticity and density was widely held and numerous mechanical ether theories proposed. Atoms in vibration were supposed to agitate the ether and produce waves in it, but no one had explained how the vibrating atoms got a grip on the ether seeing that the ether offers no resistance to the motion of the earth and planets through it.

Theories of atomic structure were in a very vague and nebulous state. Thomson's theory of atoms as vortex rings in the ether had not explained anything of importance. The science of thermodynamics had, however, been well developed and much progress made by the writings of Clausius, Rankine, W. Thomson and Willard Gibbs. The foundation stone of the science of thermodynamics was laid by the publication in 1824 of the remarkable essay by Sadi Carnot on the "Motive Power of Heat" in which he gave the Carnot cycle. This essay was, however, then known to very few. W. Thomson made acquaintance with it when as a young graduate he went for a year to Paris to work with the great experimentalist, Regnault. Thomson published in 1849 a paper in which he made known and expounded Carnot's work. Carnot's essay in French was republished in 1878, having been thus lost sight of for many years, but Thomson's paper in 1849 had by that time brought it to the notice of physicists of that day. Based on the Carnot cycle, Thomson afterwards suggested his absolute scale of temperature independent of any working substance. He also enunciated his Law of Dissipation of Energy. The fact that heat is the kinetic energy of atoms was fully understood and that the whole of any amount of mass kinetic energy could be converted into heat at a certain rate fully appreciated. But it was not so generally realized that the whole of any quantity of heat energy cannot be converted into mass kinetic energy. There was a widely diffused belief in that day that the physical theories corresponded closely to reality and that such words as size, time, mass and energy denoted actualities independent of any observer. Not every physicist, however, shared this view. Maxwell once said in my hearing, "Because we can imagine a mechanism which can achieve some result we find in Nature, it does not in the least follow that it is done in that way."

The physical theories of 1870–1880 were looked upon as well-established explanations of facts. Not ten years later, however, the first of the events occurred, namely, the Michelson and Morley experiment, which was to undermine and destroy this confidence and show that our interpretation of physical phenomena involves the observer as well as the thing observed.

When we come to look back then on the work of physicists during the eighteen seventies, what we find is that their inventions, discoveries of fact, and ascertained principles remain with us to-day of permanent value, forming part of our useful knowledge. But their theories and speculations as to underlying causes and nature have nearly all passed away. Perhaps it will also be the same with our present-day work. If some sixty years hence a fellow of the Physical Society gives a talk on the physics of the nineteen thirties, he will have to record the great additions then made to knowledge of physical facts. But he may also have to say that our explanations and theories concerning them have all vanished, or at least been replaced by others also destined in turn to pass away.

# Progressive Education

## The Spens Report*

THE publication of what has already become known as the Spens Report is of great significance for the educational system in England and Wales, and its complete or even partial adoption will be of far-reaching importance.

The Consultative Committee responsible for the Report, under the chairmanship of Sir Will Spens, master of Corpus Christi College, Cambridge, was a strong one. Its terms of reference were to examine the organization and so forth of schools other than those administered under the Elementary Code which provide education for students beyond eleven plus years, "regard being had in particular to the framework and content of the education of pupils who do not remain at school beyond the age of about 16". In view of the potent criticism aimed at present-day secondary school education in that, as the Report points out, it generally seeks to satisfy the curricula inspired by the various school certificate examinations, the latter part of the Committee's aim is well timed and of the utmost importance, because it is only a small percentage of secondary school students who eventually proceed to the universities.

To-day, the Board of Education recognizes nearly one thousand four hundred secondary schools, and these contain altogether nearly half a million students. That is, nearly 12 per cent of the child population of secondary school age in the country receive a secondary school education.

The Committee adopted a liberal point of view by considering education "in terms of activity and experience rather than of knowledge to be acquired and facts stored". It was appointed in March 1935 and since that date has examined one hundred and fifty witnesses, while various sub-committees have examined twenty-two witnesses. These witnesses can be taken as widely representing educational thought since they have been drawn from the Board of Education, directors of education and members of local education authorities, associations representing those officials, organizations representing teachers, other organizations, and many individuals including school inspectors, professors of education, psychology and physiology, and head masters and head mistresses of public, secondary, technical and senior schools.

* Report of the Consultative Committee on Secondary Education with Special Reference to Grammar Schools and Technical High Schools. Pp. xxviii+475. (London: H.M. Stationery Office, 1939.) 3s. 6d. net.

### General Recommendations

One of the outstanding features of the Report is the revolutionary changes suggested in secondary school organization and classification, to be outlined in the next section. This is doubtless due to the realization that the aim of secondary education is now not to train children "to work with their heads rather than with their hands", for conditions have now changed: democracy is challenged and "the duty of citizenship in a democracy renders it essential that all should be taught to understand and to think to the best of their ability". Those children who are capable of thinking best in abstract terms would undoubtedly derive greatest benefit from the academic training of the Grammar and Technical High School. But it is equally as important that many children, some of them of marked ability, would profit best by a Modern School education. This being so, careful allocation of children at eleven plus years from the primary schools to these schools is a matter for serious consideration.

In view of this, the Committee directs attention to the unfortunate fact that Grammar and Modern Schools are at present administered under different codes and often by different authorities. Differentiation goes even further in the scales of teachers' salaries, types of buildings, quality of equipment, size of classes and so forth. To eliminate this, it is suggested that all secondary schools—Grammar, Modern and Technical High Schools—should be placed on an equal footing so far as these conditions are concerned. The maximum size of classes should be thirty, and (with special permission of the Board of Education) should never exceed thirty-five. It is suggested, too, that all fees should eventually be abolished as soon as the financial condition of the State renders this possible.

### Schools and Their Curricula

A revolutionary change in the organization of schools offering a secondary education is visualized in the Report. It should be possible for children of eleven plus years to be transferred to one of three types of secondary school, namely, the Grammar School, the Technical High School or the Modern School (at present known as the Senior School—a term used by the Board of

Education to designate both selective and non-selective Central Schools). Transfer between these schools should be possible at thirteen plus years, but attendance should be compulsory at one or the other of them up to sixteen years. Transfer at thirteen plus years should also be possible to technical schools, which include Trade, Junior Technical, Home Management and Junior Commercial Schools: but here also, attendance up to sixteen years should be compulsory. In all types of schools, education should be brought into closer contact with the practical affairs of life, and the first two years of all schools should have a common curriculum.

Education in the Grammar School should be suitable for students passing on to the universities: but reconsideration of the curriculum in these schools is now essential. There is, at present, a grave tendency to over-work and over-strain the adolescent students, especially in girls' schools.

The curriculum in Grammar Schools should allow for the teaching of all subjects allowed at present, so far as this is possible. Proposals have already been made for a greater unification of the subjects, but these should be treated with the utmost caution. It is not certain, for example, that geography, if combined with history, could retain the distinctive character which it has achieved in the hands of modern scholars. Yet, there is much to be said for the intimate alliance between subjects, provided the essential autonomy of each is preserved. The teaching of physics and mathematics, for example, suffers much from a separation which Newton would have found incomprehensible. Subjects are also needlessly subdivided—a subdivision which in some cases, for example, mathematics (the separation of plane from solid geometry, of elementary calculus from algebra), physics and biology (for example, neglect of zoology compared with botany), tends to distort rather than bring out the characteristic architecture of the subject.

The curiosity of children of secondary school age about the practical concerns and activities of the world is frequently so strong as to amount to a passion. Advantage should be taken of this in order to bring the studies of the secondary school into closer contact than at present with the practical affairs of life. In mathematics, physics and chemistry, for example, the 'problem method' should be the standard mode of procedure—practical questions of wide interest and utility being made the occasion for the introduction of new mathematical or scientific knowledge and technique. If the utility phases were adequately developed in all subjects, everything which those concerned about 'education for citizenship' rightly demand would probably be granted.

Important defects in the teaching of mathematics are emphasized in the Report. This is ascribed to an imperfect synthesis between the idea that some parts of mathematics are useful to the ordinary citizen or to certain widely followed vocations and should therefore be taught to everybody, and the old idea that when mathematics is not directly useful it has indirect utility in strengthening the process of reasoning and in inducing a general accuracy of mind. It is suggested that mathematics can be put on a sound footing only when it is taught as other subjects should be taught, since it is one of the main lines which the creative spirit of man has followed in its development.

The approach to science, too, needs readjustment. It should not be by way of a systematic study of particular sciences, as is the method adopted in most schools. This feeling has already led, in some schools, to the provision of courses in general science as an alternative to courses in particular sciences. This general science tends to relate science to everyday experiences. It avoids what is of a purely academic nature and illustrates laws and general principles by special reference to practical applications drawn from the physical and biological worlds. In this way, general science makes more direct contact with life and creates real interests.

The teaching of science has lost close touch with life itself, and for this reason has often failed either to give the knowledge required or to stimulate the student's interest. The Committee believes that there is a general body of knowledge, not confined to either the physical or biological sciences as they are generally considered, which ought to be known by the average citizen. In boys' schools especially, science is too often restricted to the physical subjects. It is now suggested that in science teaching the pupils should be given some knowledge of the natural laws which operate in the universe. It should reveal the influence of scientific thought and achievement on the evolution of our present-day civilization, and it should show the possibilities (for good and for evil alike) in the future of the human race. The appeal here is to social interest and social utility.

Therefore, in physical sciences should be included astronomy (since the earth is only a very small portion of the whole), physics, chemistry and possibly some geology. Some astronomy is considered to be essential. In chemistry, a certain amount of organic studies, such as fermentation and saponification, should find a place, as they do in most American schools. The approach to biology should be through natural history, with primary emphasis on plants. This should merge later into the general characteristics of living organisms, taking examples from plants, and animals, including man.

In country Grammar Schools full advantage should be taken of the rural environment. Though the reforms suggested for the urban Grammar Schools apply also to rural Grammar Schools, it must be realized that the latter have special difficulties and special advantages. The resources of the countryside are at the disposal of the teacher. Rural schools enjoy unrivalled opportunities for framing syllabuses which have a high practical value derived from their close affinity to the world outside the school, and at the same time should develop in the student an inquiring and critical mind and the power of independent judgment.

Among the features prominent in the curriculum of a rural Grammar School should be the local survey and the school garden. A general local survey could be the basis of much geography and history teaching. The school garden, apart from its intrinsic merits as a means of teaching biology and agriculture, could be an agent in agricultural research such as the testing of new fertilizers. Sir John Russell stated that this has already been done in certain schools in connexion with the Rothamsted Experimental Station, and the pupils realized that they were being employed in a joint enterprise by a great scientific institution and that this was not an exercise book problem but "something which mattered". Bee-keeping and poultry husbandry should be encouraged in the rural schools. Elementary mathematics should be based on the farm and the local survey; material and statistics should be taken from them. Science should have a biological bias, and domestic science should include training in the utilization and conservation of farm and garden produce.

The technical schools of the Report include Trade Schools, Junior Technical Schools, Home Management and Junior Commercial Schools. These have developed their curricula on a broad scientific, utilitarian and vocational basis, and thus offer appropriate courses for a certain type of pupil. In this they are justified, but the Committee does not consider that they offer a real alternative to the Grammar School, and therefore it has suggested the institution of a new type of school, namely, the Technical High School.

The Technical High School should provide good intellectual discipline apart from the more purely technical training. Therefore, during the first two years, teaching should be of a general secondary school type. In other words, this school should develop a curriculum designed to provide a liberal education, with science and its applications as the core of inspiration. The subject material should include English, history, geography, mathematics, science, engineering drawing, handicrafts, physical education, æsthetic subjects, and a foreign language (preferably German) where the student shows special capability of profiting by it. The method of teaching science in the Technical High School will clearly be different from that adopted in the Grammar School. The Technical High School should also offer a new type of leaving certificate having the same status as the first school examination, that is, fulfilling first conditions for matriculation.

### First School Certificate Examination

The present first school certificate examination is subjected to severe criticism in the Report. It is remarked that the examination should follow the curriculum, not determine it. Profound changes in the syllabus are recommended, and it is suggested that greater use be made of school records.

In its present form, the school certificate tends to enforce uniformity in the curriculum. This is probably due to the fact that it is used as a test of education received and as a means of exemption for matriculation into the universities. It should not be used as a substitute for the matriculation examination, but should be a conditional first step towards the latter.

Greater freedom of choice of subjects should be allowed. There should be a reduction in content of the syllabus, and a candidate should be required to pass in at least five subjects, including English and either a foreign language or science (including mathematics). Thus, no candidate would be prevented from obtaining a certificate solely by reason of lack of linguistic or mathematical or scientific ability. The recommended reduction in content of the mathematics course and a simpler course in science would involve greater variation and some lightening of the syllabus; but no lowering of the standard of marking is implied.

Post-certificate work in the sixth form, possibly leading to the higher school certificate examination, should be encouraged for the benefit of students about to enter the universities.

### Physical and Psychological Problems

Physical and psychological problems receive due consideration in the Report. For example, physical training and physical fatigue and strain are of paramount importance in any school, and to ignore them would necessarily involve serious consequences. The physical growth of the child at puberty and adolescence must be considered in relation to such problems as posture, self-control, etc.

No adolescent, until calcification of the bones is complete, should be allowed to do heavy continuous

muscular work, either in or out of school, particularly if it involves postural fatigue. Risks of spinal curvature must be avoided, and the importance of adequate rest in a suitable position should receive careful consideration.

The onset of puberty must be recognized by the authorities through the characteristic well-marked physical and mental changes, and due allowances made for it. During this period, especially in girls, ample provision should be made for a liberal dietary and well-balanced periods of exercise, rest and sleep.

It is a matter for regret that some authorities do not provide for medical inspection and treatment in Grammar Schools. The practice of medical inspection and treatment should be made universal, and medical officers should be encouraged to undertake a wider scope of inquiry. Meals should be available at all schools, and in arranging the dietary, the school medical staff should be consulted.

The psychological factors influencing the pupil in his mental development and his education should be studied continuously by the school teaching and school medical staff. These include the general characteristics of puberty and adolescence, mental and intellectual abilities, individual differences and special intellectual capacities, sensory capacities, attention, memory, imagery, reasoning, emotion, social impulses, self-assertion and submission, and so forth. In fact, the application of psychology to the study of the school child is of a special character, and therefore cannot be ignored. All trained teachers have received special instruction in this aspect of their careers, and this should make these problems less formidable than they would otherwise be, but it does not detract from their importance.

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# The Weather in Great Britain during 1938

By E. G. Bilham

SIR NAPIER SHAW, in the delightful Christmas card which his friends have been privileged to receive, describes the year 1938 as *annus memorabilis*. The description is a happy one, for the year was memorable in many respects. The amount of material available at the moment for the purpose of summing up the features of the year as a whole is relatively small, and we cannot here attempt anything in the nature of a detailed discussion. It has been thought, however, that a retrospect of the more striking meteorological events would be of interest.

The year began with a mild, wet and stormy January. In many parts of England and Wales no temperature below 32° F. was recorded, and in most districts the mean for the month was about three degrees above normal. Gales were numerous, and that on January 14–16 was exceptionally severe. A gust of 101 miles per hour was recorded at St. Ann's Head on January 15. A similar velocity was reached at the Liverpool Observatory on January 29, and 100 miles per hour was also recorded in the Orkneys on January 23. A magnificent display of the aurora occurred on the night of January 25–26.

Conditions in respect to warmth and wind were less abnormal in February, but it produced one of those coincidences of tidal and meteorological conditions necessary for the occurrence of floods on the east coast of England. Such flooding occurs when a wind-induced deepening of the waters of the North Sea, due to strong winds from the north-west quadrant, coincides with a high predicted tidal level. These conditions prevailed on the evening of February 12, when the sea burst over the low-lying coastland between Winterton and Palling in Norfolk and flooded an area of the order of fifteen square miles. Later, on April 3, the sea broke through the defences at Horsey and caused a further extensive inundation. The rainfall of February was very deficient except in parts of Scotland, the general fall over England and Wales being about half the normal.

The shortage of rainfall south of the Border was accentuated in March, when the general fall for England and Wales was only 27 per cent of the normal. It was the driest month of that name at many stations. On the other hand, parts of Scotland had excessive rainfall, as much as 50 inches being recorded at Loan (Loch Quoich). The month will also be remembered for its remarkable warmth. Previous records of mean temperature were exceeded by a substantial margin. For example, at the Radcliffe Observatory, Oxford, where records on a comparable basis are available back to 1815, March 1938 gave a mean value exceeding the previous highest (1822, 47·3° F.) by as much as 2·6° F.

April continued the sequence of dry months. For the British Isles as a whole, it was the driest April on record, and probably the driest month of any name. The total rainfall of the three months

February to April 1938 was less than that of any similar period back to 1785. Some rural districts experienced an acute shortage of water. Severe frosts during the periods April 9–11 and again about April 18–19 caused much damage to the blossom and buds of fruit crops.

There were further damaging frosts in the early days of May, the reading of the screened minimum thermometer being as low as 18° F. on May 8 at Thetford, Norfolk. A week later a temperature as high as 79° F. was registered at Norwich and Canterbury. June was rendered noteworthy by the great gale on June 1–2, during which the gusts recorded on the south coast were comparable with those of severe winter storms. This storm produced a remarkable discoloration of foliage of trees in the south of England, due probably to the combined effects of buffeting and salt spray borne inland by the wind.

July was a wet month, with a very marked deficiency of sunshine. A very heavy rainfall occurred in the English Lake District on July 29; the reading amounted to 5·95 in. at Watendlath Farm and to 5·60 in. at Borrowdale.

The first day of August was the warmest of the year, 87° F. being recorded in London on that day. Thunderstorms were frequent and severe during August. During one of these the remarkable rainfall of 6·39 in. occurred at Torquay on Aug. 4.

The early autumn was relatively uneventful, but November was remarkable for exceptional warmth in all districts. On November 5, 70° F. was registered in many parts of east and south-east England. The mean temperature of the month, 49·3° F., was the highest in November at Oxford since 1818. A very severe gale occurred on November 23, the gust velocity reaching 108 miles per hour at St. Ann's Head; 98 miles per hour was registered at Stornoway on November 18.

The abnormal warmth was maintained during the first half of December. There was an abrupt change on December 17, when Great Britain began to be affected by very cold air spreading eastward from the continent of Europe. The wintry conditions lasted over the Christmas holiday period and the southern districts thus experienced the unusual phenomenon of a 'white Christmas'. At Manston, Thanet, during the period December 17–24, temperature remained continuously below freezing point for 147 hours, and at Lympne, Kent, similar conditions persisted for 222 hours, apart from a break of a few hours on December 24. At the latter station the maximum temperature on December 20 was no higher than 22° F. Although the period was certainly the most severe since February 1929, the extreme minimum temperatures were not specially remarkable, the lowest so far reported being 7° F. at Dalwhinnie on December 19.

# Obituary Notices

## Prof. George Barger, F.R.S.

THE sudden death on January 6 of Prof. George Barger, at the early age of sixty years, has come as a shock to all those, in many countries, who were his friends. Barger was born in Manchester in 1878, his father being Dutch, his mother English; and his childhood in a bilingual home, followed by schooling in Holland, laid the basis of that easy fluency in many languages which so distinguished him in later life. He returned to his native England for his university courses, entering King's College, Cambridge, with a scholarship in natural science, after a year at University College, London. In 1904 he was elected a fellow of King's College.

The fact that Barger was placed in the first class in both botany and chemistry in Part II of the Natural Sciences Tripos seemed to leave the direction of his life's work in doubt; but, though his first appointment was as demonstrator in botany in Brussels, under the late Prof. Errera, the researches which he there began were essentially chemical, and included an ingenious and useful method of determining molecular weights on very small samples, by the comparative measurement of the vapour pressures of solutions. His next appointment was as chemist to the Wellcome Physiological Research Laboratories, where he had already begun some chemical fractionations of the constituents of ergot, when I became associated with him, in 1904, in a collaboration extending over five active and happy years.

The first stage culminated in 1906 with the isolation by Barger, with F. H. Carr, of the alkaloid ergotoxine, which cleared the subject of a confusing competition of impure 'principles', and opened the way to the discovery by others of a series of related alkaloids, extending over the intervening years to the present day. Then came the recognition in ergot extracts of a series of simple, active amines derived from amino acids; tyramine first, and Barger's synthesis of a series of 'sympathomimetic' amines leading from tyramine to adrenaline; and later histamine, which Barger also first isolated from an animal (intestinal) extract, thus opening the way to important chapters in physiology and pathology. Another simple base which has recently figured prominently in physiological conceptions, acetylcholine, was found a few years later in an ergot extract by Barger's former pupil and co-worker, A. J. Ewins, after Barger himself had gone to an academic appointment in chemistry at the Goldsmiths' College, Lewisham, from which, after some years, he passed to the chair of chemistry at the Royal Holloway College, London.

Barger and I became intimate colleagues for a second period, starting in July, 1914, when we joined the staff of the National Institute for Medical Research, then newly projected by the Medical Research Committee. The outbreak of war a month later deferred all normal plans, sent us into temporary quarters, and absorbed our activities in various urgent and largely separate problems. On some of these Barger did work of the highest national importance, which he would have wished to remain unrecognized. Our direct collaboration came to an end with Barger's appointment in 1919 to the chair of chemistry in relation to medicine, then founded in Edinburgh. Circumstances prevented the full realization of the scheme, which was to have put Barger in charge of the chemical aspects of teaching and research in all the medical sciences; but he retained the chair for eighteen years, and made his department an important centre of research in chemistry, often with a medical or biological outlook, to which workers came from most parts of the world.

Of achievements by those who had been Barger's pupils and collaborators in this period, mention may be made of Harington's work on the structure and synthesis of thyroxine, of which the concluding stage was published jointly with Barger; of Stedman's work on the structure of physostigmine, on artificial analogues of that alkaloid, and on the enzyme, cholinesterase, by depressing the function of which physostigmine and its allies produce their physiological effects; and of the work of Todd and his collaborators, on the structure and the synthesis of the vitamin $B_1$ (aneurine).

Barger, by himself, and with various collaborators from a number of countries, carried on, in the same period, a series of fundamental researches on the structure of certain alkaloids—carpaine, galegine, calycanthine and others—and synthesized the amino acid methionine. Though his interests in biology and medicine, and his contacts with workers in those fields, were wide and numerous, he always regarded himself as a chemist, and was especially gratified by recognitions of the importance of his work for chemistry as such, as by the Longstaff Medal of the Chemical Society in 1936, and by the Davy Medal of the Royal Society, awarded less than two months before his death. His position among leading British chemists had been fitly recognized by his appointment, in 1937, to the Regius professorship of chemistry in the University of Glasgow; but he has not lived to show what he would have made of this wider opportunity.

Apart from the numerous scientific papers published in his own name, and by pupils whom he guided and inspired, Barger published two important monographs, both dealing with interests which he acquired during our early association, and later extended. The smaller of these dealt with "The Simpler Natural Bases"; the larger and later one, based on the Dohme Lectures which he gave in Baltimore in 1928, and dealing with "Ergot and Ergotism", is a masterly piece of work, embodying much patient and scholarly historical research, and showing an unrivalled scientific grasp of the problems presented by a many-sided and fascinating subject.

Barger received many degrees from foreign universities, and was member of a number of foreign academies; but these honours do not in any way indicate the degree to which he became a truly international figure in science. His acquisition of several languages in boyhood made it easy for him to learn others, and he continued throughout life to perfect his command of those he had, at every opportunity of practice, and to seize every excuse, whether of holiday or congress, to add another to his equipment. He had a mind avid for new information and experience, and travelled often and widely, making friends in all countries. He was eager to become familiar not only with the languages, but also with the historical backgrounds and habits of thought of other peoples, and was constantly active to promote international understanding and good will. He gave and received staunch friendship, but, widely beyond the circle of those who enjoyed his intimate confidence, his loss will be mourned in many countries as that of a great figure in science, and of a generous and understanding colleague. There will be widespread sympathy with his widow, his two sons and his daughter, in their tragically sudden bereavement.

H. H. DALE.

## Prof. Ferdinand Hueppe

WE regret to announce the death in Dresden at the age of eighty-six years of Geheimrat Ferdinand Hueppe, honorary senator of the Technical School of Dresden, who was not only one of the founders of modern bacteriology but also an eminent authority on public health, biology and the medical aspects of athletics.

Hueppe was born on August 24, 1852, at Heddesdorf near Neuwied on the Rhine. He qualified in Berlin in 1876 with a thesis on ovarian and abdominal pregnancy, and for the next nine years served as a medical officer in the army, during which period he paid special attention to systematic physical exercise. In 1885 he left the army and founded a Department of Hygiene and Bacteriology in the Chemical Institute of Fresenius at Wiesbaden. In 1889, he was made professor of hygiene in the German University at Prague and held this appointment until 1912, when he settled in Dresden. In 1903 he delivered the three Harben lectures in London before the Royal Institute of Public Health on the etiology of infectious diseases, hygiene and serum, and tuberculosis respectively.

Hueppe was a prolific writer. In addition to a work on the methods of bacteriological research, and another on the forms of bacteria, he wrote on milk, water, typhoid fever, cholera, alcoholism, vegetarianism, and social and racial hygiene. J. D. R.

We regret to announce the following deaths:

Dr. F. P. Burt, M.B.E., reader in stoichiochemistry in the University of Manchester.

Prof. A. W. Porter, F.R.S., emeritus professor of physics in the University of London, on January 11, aged seventy-five years.

# News and Views

## Sir Ambrose Fleming, F.R.S.

At the meeting of the Physical Society held at the Imperial College on January 13, Sir Ambrose Fleming delivered an address on "Physics and Physicists of the Eighteen-Seventies", the substance of which appears elsewhere in this issue (p. 99). At the time of the jubilee of the Society in 1924, five of the ninety-nine original fellows were living; now, in his ninetieth year, and enjoying remarkably good health, Sir Ambrose is the sole survivor. Mr. O. J. (now Sir Oliver) Lodge became a fellow in 1875, the year after the foundation of the Society, and was its president from 1889 until 1901. At the inaugural meeting of the Society, the first paper "On the New Contact Theory of the Galvanic Cell" was read by Mr. J. A. Fleming at the invitation of the founder, Prof. Frederick Guthrie. That paper will be reprinted in the Society's *Proceedings*, together with the address he has now delivered after an interval of nearly sixty-five years. This is an event that must surely be unique in the history of learned societies. In addition to his many other honours, Sir Ambrose received the Duddell Medal of the Physical Society in 1930.

## M. Bernard Lyot

The Gold Medal of the Royal Astronomical Society has been awarded to M. Bernard Lyot, of the Meudon Observatory, France, for his observations and photography of the solar corona in the absence of a total eclipse. In 1868, Lockyer and Janssen showed that prominences could be observed when the sun was not eclipsed. In 1882, Huggins attempted the more difficult problem of observing the corona without an eclipse, and both Hale and Deslandres in 1893 designed apparatus for the chromatic isolation of the green line. These efforts were entirely unsuccessful. M. Lyot went much more thoroughly into the optical conditions necessary to eliminate the diffused sunlight. The light of the sun is a million times that of the corona, and at Meudon the scattered sunlight at 1′ from the sun's limb cannot be reduced to less than twenty or thirty times that of the corona, but on the Pic du Midi, after a fall of snow, the stray light on occasions is not of greater intensity than the light of the corona at 1′ from the limb. But a very large amount of stray light is incidental in the optical systems usually employed, which M. Lyot has analysed into diffraction round the edge of the objective lens, scratches and bubbles on the lens, and reflected light from the back of the lens. By arranging screens to cut off the light from these several sources, he has succeeded in photographing the inner corona, obtaining a spectroheliogram in light 5303 A., and measuring the polarization all around the limb; in addition, he has obtained accurate wave-lengths of a number of the emission lines of the corona, as well as the width of the lines.

## Prof. H. H. Read

Prof. H. H. Read, who has just succeeded Prof. P. G. H. Boswell in the chair of geology at the Imperial College of Science and Technology, London, received his early training in the Royal College of Science under Prof. W. W. Watts. He was appointed to the Scottish branch of H.M. Geological Survey in 1914, but his career was almost immediately interrupted by the outbreak of the Great War. During 1914–17, he was absent on military service in Egypt, Gallipoli and France. In 1917 he was invalided out of the army and resumed work in Scotland, where he remained until 1931. During this period, Dr. Read spent much time in surveying in the central and northern Highlands, and in Shetland, and as a result developed a special interest in igneous and metamorphic geology. In 1929–30, he served as president of the Edinburgh Geological Society. In 1931, he resigned from the Geological Survey on appointment as George Herdman professor of geology in the University of Liverpool. During the last twenty years, Prof. Read has published a number of important papers, mainly on problems connected with the igneous and metamorphic geology of the north of Scotland and Shetland; and in 1935 he was awarded the Bigsby Medal of the Geological Society of London for these researches. He has been chosen as president of Section C (Geology) for the meeting of the British Association in Dundee this year, an appointment which is peculiarly appropriate, in view of his interest in Scottish geology.

## Dr. R. L. Smith-Rose

The Radio Department of the National Physical Laboratory is, as were the two organizations by the fusion of which it was formed in 1933, occupied almost wholly on work within the programme of the Radio Research Board, and Dr. R. L. Smith-Rose, whose appointment as superintendent of the Department was announced in these columns last week, has been associated with the work of the Board from its formation. Dr. Smith-Rose, who was born in 1894, studied at the Imperial College of Science and has, alone and in collaboration with departmental colleagues, published an impressive array of important papers, some seventy in number, on radio direction-finding, the propagation and attenuation of radio waves, the properties of ultra-short waves, the screening of radio circuits and the measurement of radio field-intensity. His principal work has been in the laying of the scientific foundations of radio direction-finding, alike as an aid to navigation by sea and air and as an essential element in studying the properties and propagation of radio waves in general. From the first adequate survey of the accuracy of closed-coil direction-finding, when the

instrument was the main contributor to the quite serious inaccuracies found, he and his co-workers have continued over the greater part of twenty years an advance which has brought them now, using "the most perfect direction-finder in the world", to the estimation of the natural (propagational) limits to the accuracy of practical direction-finding. The greatest individual landmark on this road was the rediscovery and extension of the Adcock system for the reduction of errors due to horizontal electric forces in the received wave front. The National Physical Laboratory may justly be proud of the fact that the principle embodied in every good direction-finding installation in the world to-day is due initially to one member of its staff, Adcock, and owes its great development to two others, Smith-Rose and Barfield.

DR. SMITH-ROSE, whose D.Sc. (London) was conferred for a thesis on direction-finding, was awarded a Student's and a Wireless Premium of the Institution of Electrical Engineers for contributions to its Journal. He is a member of the British National Committee for Scientific Radiotelegraphy, to which he was appointed by the council of the Royal Society, and has been a prominent participant in all the General Assemblies of the Union Radio Scientifique Internationale, save the first. He participated with the British delegation in the Bucharest meeting of the International Consultative Committee for Radiotelegraphy, is a member of the Wireless Section committee of the Institution of Electrical Engineers, and has rendered valued services as vice-chairman (chairman of the staff side) of the Departmental Whitley Council of the Department of Scientific and Industrial Research.

## Geological Society: Medal and Other Awards

THE following awards of the Geological Society have recently been made: Wollaston Medal to Prof. F. D. Adams, emeritus professor of geology and palæontology in McGill University, for his researches on the Pre-Cambrian rocks and on the influence of high temperatures and pressures on the properties of rocks at great depths in the earth's crust; Murchison Medal to Dr. H. Jeffreys, in recognition of the value of his researches on the constitution and physics of the earth's interior, and in particular of the deductions he had drawn from the analysis of records of distant earthquakes; Lyell Medal to Prof. W. N. Benson, professor of geology in the University of Otago, in recognition of the wide range and excellence of his geological researches, particularly in New Zealand; Prestwich Medal to S. Hazzledine Warren, in recognition of his researches on the geology and archæology of East Anglia, particularly of the Lea Valley; Bigsby Medal to Prof. A. E. Trueman, professor of geology in the University of Glasgow, in recognition of his outstanding contributions to the knowledge of palæontology and stratigraphy, particularly of the Coal Measures and the Lias; Wollaston Donation Fund to I. S. Double, for his work on the petrology of sedimentary rocks, especially the Tertiary rocks of the east of England, the Glacial deposits, the Chalk and the Trias; Murchison Geological Fund to Dr. A. L. Coulson, in recognition of his geological work in India, especially that concerned with earthquakes and meteorites and the survey of Rajputana; a moiety of the Lyell Geological Fund to Dr. W. Q. Kennedy, for his petrological work, especially in connexion with the Tertiary complexes of the Hebrides and the metamorphic rocks of the Western Highlands; a second moiety of the Lyell Geological Fund to Dr. A. Raistrick, for his researches on the minute structure and constitution of coal, and on the past floras of Britain as revealed by the study of peats.

## Sir Isaac Newton's Prisms

IT is reported from Italy that three optical prisms formerly belonging to Sir Isaac Newton have now found a permanent resting place in the Museum of Treviso. The prisms in question were originally in the possession of Newton's step-niece, Mrs. Conduitt (1680–1739), who spent some fifteen years looking after Newton's house, until her marriage in 1717, to Mr. Conduitt, Newton's successor at the Mint. They were acquired from Mrs. Conduitt by Count Francesco Algarotti, a Venetian nobleman and a prominent figure in London society during the middle eighteenth century. After many changes of ownership the prisms were deposited some years ago in the Treviso Museum, to which institution they were recently bequeathed by the late Prof. Luigi Bailo. Although there seems little doubt that these prisms were at some time associated with Newton, it is not easy to assess what part they played in the fundamental discoveries and subsequent work of Newton on the dispersion of white light. Signor Algarotti was a great admirer of Newton and was the author of "Sir Isaac Newton's Philosophy explained for the Use of Ladies". In the English translation, published in 1739, we learn (vol. 2, p. 70) that Algarotti had found that the prisms available in Italy were unsuitable for repeating Newton's experiments, but that he had been fortunate enough to receive from England some which proved excellent. Later in the same volume (p. 129) we read "I have myself seen the first telescope [Newton's reflecting telescope] . . . preserved in a city of England . . . with this are treasured up those prisms which the first time differently refracted the rays of light in the hands of our great philosopher. . . ." There is no doubt that from about 1664 onwards Newton used many prisms in his experiments and fortunately one of these, at least, is preserved in Great Britain; it was presented in 1927 to the British Museum by the Rev. H. T. Inman, who in a private publication has very carefully traced its descent from Newton. It is made of flint glass, and confirmatory evidence of its date has been adduced from the nature of the glass.

## Science and National Defence

THE Association of Scientific Workers, 28 Hogarth Road, London, S.W.5, has had under consideration the position of science in Great Britain in relation to problems of national defence, and has issued a statement defining its attitude. While the Association regards war as the supreme perversion of science, it

is nevertheless prepared to assist in measures for defence against anti-democratic movements. To this end, it stresses the importance of the immediate formation of an organization to see that the most efficient use is made of scientific knowledge; the following points are put forward for consideration:

"(1) It is in the best interests of the country that scientists should be utilized in scientific work, and that the organization and control of scientific work should be in the hands of scientists.

"(2) The professional organization of scientists should play an important part in drawing up and operating any scheme of organization and also be represented on scientific advisory committees to the defence departments.

"(3) In any scheme of registration, scientists should be grouped on a laboratory basis, no matter whether university, special research or industrial. It is particularly important that scientific workers in industry should be included in any such scheme and not left at the disposal of individual employers. Further, scientists should be consulted *now* with regard to such organization, firstly on the grounds of efficiency and secondly to secure its democratic working.

"(4) Some machinery should be provided whereby scientists, including those in service departments, may exercise a right of criticism on purely scientific and technical matters.

"(5) It is important that scientific and technical as well as medical education should be maintained in time of war."

## New Chancellor at the University of Leeds

On January 17, with appropriate ceremony, the University of Leeds installed the Duke of Devonshire as chancellor in succession to his father, who had occupied that post for nearly thirty years, having succeeded the first chancellor of the University, the Marquess of Ripon, in 1909. The proceedings commenced with a lunch to the honorary graduands and to the representatives of other universities and of local education authorities, given by the Court of the University, in the fine new Civic Hall rendered available through the courtesy of the Lord Mayor of Leeds. The ceremony of installation took place in the Town Hall, in the presence of representatives of all sections of the University, and other universities, of local authorities in Yorkshire, together with other dignitaries. His Grace was received by the vice-chancellor, Mr. B. Mouat Jones, who presented him with the scroll recording his admission to the honorary degree of doctor of laws of the University, and then installed him as chancellor, delivering a brief address of welcome. After the chancellor's response, a number of honorary degrees were conferred. Earl Baldwin of Bewdley and the Right Hon. W. S. Morison, Minister of Agriculture and Fisheries, were presented for the degree of LL.D. The degree of D.Sc. was conferred upon Sir Arthur Eddington, Plumian professor of astronomy and director of the Observatory, Cambridge, upon Sir John Ledingham, director of the Lister Institute, and upon Dr. J. S. B. Stopford, formerly professor of anatomy and now vice-chancellor of the University of Manchester. In the evening, the Chancellor and the Duchess of Devonshire received the guests at a reception in the University, when many scientific and technological departments were thrown open, special demonstrations being on view. These exhibits remained open for inspection by the general public throughout the following day.

## Botanic Gardens of the World

We have received the second edition of the list of botanic gardens of the world compiled under the direction of Dr. Stuart Gager, director of the Brooklyn Botanic Garden ("Botanic Gardens of the World: Materials for a History". *Brooklyn Bot. Rec.*, **27**, No. 3, July 1938. Price 2 dollars 50 cents). Apart from its intrinsic value to botanists, the list will prove helpful to research botanists and teachers of botany who may require information or material from definite localities. In this way, the list forms a sure guide. But there are inconsistencies in the information given concerning each individual garden. This is due to the fact that the compiler has been at great pains to make the information authoritative by obtaining it from the source, namely, the gardens themselves. In this, Dr. Gager experienced certain difficulties, since, though most garden officials supplied all the necessary information, some made no or scant reply to the questionnaires sent. Where the information can be considered complete, it is of great utility. For example, under the Royal Botanic Gardens, Kew, are listed date of establishment, area, list of directors, organization, source of income, library, herbarium, arboretum and fruticetum, plantations, publications, museums, etc. The list is not intended to be simply a guide to existing botanic gardens, but as material for a history of botanic gardens, existing or defunct, and "thus as a contribution to one of the most important phases of the history of the organization and administration of botanical science, from the time of Aristotle to the present". Such a history would receive a warm welcome from all botanists, since we believe no such comprehensive history exists at present. We would suggest one slight improvement in the next edition of this list, which would undoubtedly render reference more easy. The gardens are arranged alphabetically under each country, and the latter in turn are arranged alphabetically. There are, however, no page headings (except page number). It would be a distinct advantage if the name of the country were placed at the top of each page.

## Folk-lore and Medicine

At a meeting of the West London Medico-Chirurgical Society on January 13, Dr. J. D. Rolleston read a paper on "Folk-lore and Medicine". He said that since the publication in 1927 of the late Dr. Dan McKenzie's work entitled "The Infancy of Medicine: an Enquiry into the influence of Folk-lore upon the Evolution of Scientific Medicine", the subject of folk-lore in connexion with medicine has attracted little attention in Great Britain, in marked contrast with the enthusiasm which it has provoked on the Continent. The various prophylactic and therapeutic measures in folk-lore medicine, in which the curative methods far outnumber the preventive, can be ranged under one or more of the following headings: (1) trans-

ference of the disease to other persons, animals or inanimate objects; (2) animal, plant or mineral remedies; (3) religious influences, including the invocation of special saints; (4) the healing power attributed to water in the form of wells, springs, fountains and streams; (5) the mystical power of odd numbers; (6) repellent and disgusting remedies, including coprotherapy, for the purpose of drawing out the evil spirit supposed to be the cause of the disease; (7) miscellaneous causes, such as the doctrine of signatures, constriction by rings, charms connected with death or the grave, etc. The diseases and symptoms for which the largest number of folk-lore remedies and preventive methods have been applied are whooping cough, 'ague', including not only malaria, but also as its etymology indicates, any acute fever, epilepsy and convulsions of any kind, rheumatism, consumption, eye diseases, skin diseases, especially warts, cattle diseases, headache, toothache, jaundice, hæmorrhages of any kind, and bites of snakes and scorpions. After giving numerous examples of folk-lore medicine in whooping cough, epilepsy, rheumatism and jaundice, Dr. Rolleston concluded by saying that, though many folk-lore remedies have become obsolete, some are still practised, not only by the inhabitants of remote country districts, but also by educated persons in large cities.

### The New Deal in Education in the United States

THE Federal Government of the United States seems likely, in future, to play an increasingly important part in the education services of the States. A summary has recently been published ("The Federal Government and Education". Washington, D.C.: Superintendent of Documents. Price 10 cents) of certain findings and proposals of the President's Advisory Committee on Education relating to present conditions with special emphasis on inequalities of educational opportunity, the national interest in education and proposals for federal grants amounting in 1939–40 to 72 million dollars and increasing gradually to 202 millions in 1944–45. The Committee found that "glaring inequalities characterize educational opportunities throughout the nation" and it is argued that federal aid is the only way of adequately remedying this evil. It is pointed out that while the abilities of the States and local communities to provide education have always been unequal, recent changes in social and economic conditions have magnified this inequality and at the same time education has become increasingly important. Fundamentally the inequality is largely due to drainage of wealth, through migration and modern methods of organization of manufacture, commerce and finance, from all parts of the country into the towns and cities and particularly the great metropolitan areas. Hence such glaring contrasts as that between a farm population in the south-eastern States responsible for 4¼ million children, with only 2 per cent of the national income, and a non-farm population in the north-east with 8¼ million children, and 42 per cent of the national income—21 times as much income from which to educate only twice as many children.

### The Josiah Macy, Jr. Foundation

IN a six-year review of the activities of the Josiah Macy, Jr. Foundation, New York, 1930–1936, Dr. Ludwig Kast, president of the Foundation, reports that up to December 31, 1936, the Foundation made 324 grants, amounting to 806,681 dollars, to thirty-four different universities and twenty-seven other agencies for research in the United States, Belgium, Czechoslovakia, France, Germany, Hungary, Netherlands and the U.S.S.R. Special reference is made in the report to the interest of the Foundation in psychosomatic problems, including a survey of the relation of emotion to disease, to its support of investigations upon growth, development, maturation and ageing, the bearing of which upon the changing age distribution of population in the United States and the problems arising from that trend are stressed, as well as in social research concerning health and sickness and medical education. The Foundation in 1933 published the results of a review of the available data and immediate problems in human arteriosclerosis in a volume entitled "Arteriosclerosis: a Survey of the Problem", and the report emphasizes that, in view of the tendency for the age distribution of population to change towards a predominantly older group with a smaller population less than twenty years of age, the problems associated with the ageing of individual men and women are not merely medical problems but also require study by workers in other branches of science, such as economics and sociology. A chronological list of grants is included in the report.

### Steam Boilers for Electric Power Stations

CONSIDERABLE progress has recently been made in developing the type of boiler used in electric power stations. It is now generally recognized that considerable economies can be effected by the use of larger steam-generating units, higher steam pressures and higher temperatures. The average capacity of boilers now being installed in power stations has risen to nearly 200,000 lb. of steam per hour. These work in conjunction with alternating current generators giving 30,000–50,000 kilowatts. In the *Electrical Times* of November 24 a description is given by Mr. V. Walker of a number of the latest types of boilers recently installed. Attention is also directed to the alterations made necessary when pulverized fuel is used. Messrs. Babcock and Wilcox have developed some of their boilers so as to take advantage of the economies inherent in the use of high rates of heat release per square foot of furnace now obtainable. They have designed a boiler for the Brighton Corporation so as to have a normal evaporation of 175,000 lb. per hour at 675 lb. pressure per square inch and 875° F. To overcome the difficulties of natural circulation, forced circulation has been developed. Two other types of boiler, the La Monte and the Loeffler, are also being installed in Great Britain.

### Recent Additions to the British Museum (Bloomsbury)

AMONG the additions of archæological interest reported at the meeting of the trustees of the British Museum (Bloomsbury) on January 14, was a

collection of bronze age pottery from Cyprus, which had been excavated by Mr. J. R. Stewart from two graves at Vounous in that island. The pottery belongs to the periods Early Cypriote I*a* and I*b*, dating from about 2800–2700 B.C., and Early Cypriote II*a*, which is placed at approximately two hundred years later. Lieut.-Colonel H. H. R. Deane has presented a collection of examples of Buddhist art, consisting of twenty pieces, mostly small stone figures, belonging to the Gandhara School, dating from the second to fourth centuries A.D. These were collected in the North-West Frontier Province by the late Lieut.-Colonel H. A. Deane.

### Recent Appointments in the Colonial Service

THE following appointments in the Colonial Service have recently been made: *Colonial Forest Service*, W. B. Collins, Gold Coast; D. F. Davidson, Cyprus; M. T. Horwood, Gold Coast; F. C. Hummel, Uganda; T. W. Hussey, Nigeria; D. M. M. Kellas, Gold Coast; D. A. Lane, Gold Coast; H. M. Maughan-Brown, Sierra Leone; W. A. Miller, Gold Coast; J. M. Ramsay, Gold Coast; G. G. K. Setton, Fiji; P. G. Shillitoe, Tanganyika. *Colonial Agricultural Service*, C. Harvey (agricultural officer, Tanganyika Territory), senior agricultural officer, Fiji; F. L. Squibbs (director of agriculture, Seychelles), agricultural officer, Gold Coast. *Colonial Geological Survey Service*, J. B. Alexander (geologist, Nyasaland), geologist, Federated Malay States; H. Service (geologist, Gold Coast), geologist, Federated Malay States. *Colonial Veterinary Service*, W. G. Beaton (senior veterinary officer), deputy director of veterinary services, Nigeria; H. J. Lowe (senior veterinary officer), director of veterinary services, Tanganyika Territory; Captain W. L. S. Mackintosh (veterinary officer), senior veterinary officer, Uganda; R. J. Simmons (senior veterinary officer), director of veterinary services, Uganda. *Other Branches*, W. R. Chanmugam (assistant Government analyst), deputy Government analyst, Ceylon; Miss R. M. Henderson, bacteriologist, Veterinary Department, Kenya; G. P. C. Lewis, inspector of plants and produce, Gold Coast.

### Announcements

M. L. CAYEUX, member of the Paris Academy of Sciences and honorary professor of geology at the Collège de France, has been awarded the Paul Fourmarier Prize and gold medal by the Royal Academy of Belgium.

THE Council of the Institution of Naval Architects has awarded the Gold Medal of the Institution for the year 1938 to A. P. Cole, for his paper "Destroyer Turning Circles", and the Premium to Dr. F. H. Todd and J. Weedon for their joint paper "Further Resistance and Propeller Experiments with Models of Coasters". The Wakeham Prize for 1938 has been awarded to I. C. Bridge for his paper "Structural Stress in an Oil Tanker Under Service Conditions". These awards will be presented at the annual general meeting on March 29 at the Royal Society of Arts, John Street, London, W.C.2.

THE Gold Medal of the International Faculty of Sciences, which is awarded annually in recognition of outstanding contributions to scientific progress, has been awarded for 1938 to Mr. J. J. Denton, secretary of the Television Society, and vice-president of the Institution of Electronics. The award is in recognition of nearly fifty years' continuous devotion to scientific and technical education.

THE herbarium and library of the Botanical Museum of the Academy of Sciences of the U.S.S.R. are being transferred from Leningrad to Moscow. It is not expected that the new museum in Moscow will be ready for another five years. The Botanical Gardens in Leningrad will be retained.

WE have received a new schedule of fees for tests on volumetric glassware at the National Physical Laboratory which came into operation on December 1, certain modifications in the method of charging being introduced. The tests available and the methods used are described in a pamphlet entitled "Tests on Volumetric Glassware" which, together with the schedule of fees, may be obtained on application to the Director, National Physical Laboratory, Teddington, Middlesex.

THE Educational Advisory Board of the British Social Hygiene Council is holding a Summer School, dealing with "Biology in Human Life", probably at Cambridge, on July 28–August 4. The School will include courses on social biology, and the place of the teacher with regard to the teaching of sex, and lectures by experts on recent developments in the biological field. The course is intended for all teachers, particularly those in senior and secondary schools, who are interested in biological problems as they affect human life and society. Further particulars can be obtained from the Education Officer, British Social Hygiene Council, Tavistock House South, Tavistock Square, London, W.C.1.

THE fourth biennial Child Guidance Conference will be held at the British Medical Association House, Tavistock Square, W.C.1, on January 27–28, when the subjects for discussion will include: treatment of parents, juvenile delinquency, personality deviations and diagnosis of psychoses, the scope of the educational psychologist working in the schools and substitute homes. A session for administrative regulations will also be devoted to the consideration of the findings of the Feversham report on the voluntary mental health services as they affect the policy and administration of the child guidance movement. Further information can be obtained from the Secretary, Child Guidance Council, Woburn House, Upper Woburn Place, W.C.1.

ERRATUM.—In NATURE of December 3, 1938, p. 997, col. 2, letter by Prof. A. Schönberg, last reaction:

$$\text{for } \begin{matrix} \text{Ph.CO.C.CO.Ph} \\ \| \\ \text{Ph.N} - \text{O} \end{matrix} \quad \text{read} \quad \begin{matrix} \text{Ph.CO.C.CO.Ph} \\ \| \\ \text{Ph.N} \rightarrow \text{O} \end{matrix}$$

# Letters to the Editor

*The Editor does not hold himself responsible for opinions expressed by his correspondents. He cannot undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*

NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 122.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

## Human Cancer and the Theory of 'Cancer Phage'

To explain the observed fact that, in England and Wales for ages above fifteen years, the decrease in deaths from phthisis has been exactly compensated by the increase in deaths from cancer[1], I have postulated the existence of a *Bacillus tuberculosis* 'phage' which is carcinogenic[2]. The idea has been followed up in more detail, and several additional relations of cancer and tuberculosis, all of which support the phage concept, have been disclosed.

If in any age group $x$ persons die of cancer and $y$ of tuberculosis, then the relative tendency of the hypothetical 'complex' of bacillus and phage to break down in the direction of cancer as opposed to tuberculosis is $x/y$. This 'virulence ratio', $R$, is a measure of the balance of the 'complex' and becomes the unit of measurement of the theory.

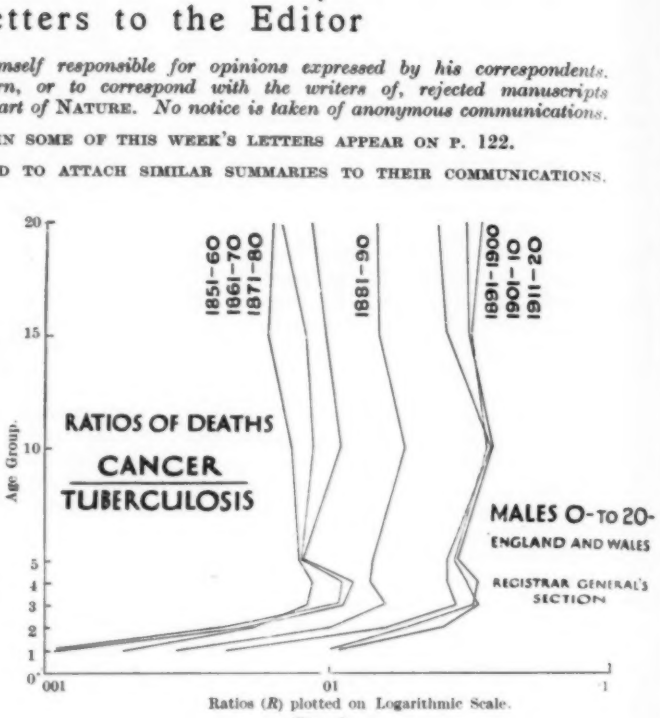



Fig. 2.

The values of $R$ increase rapidly with age, and from twenty-five years onwards, to a close approximation $R_t = R_0 e^{kt}$, a law in harmony with the idea of the phage multiplying within the bacillus. (Fig. 1.)

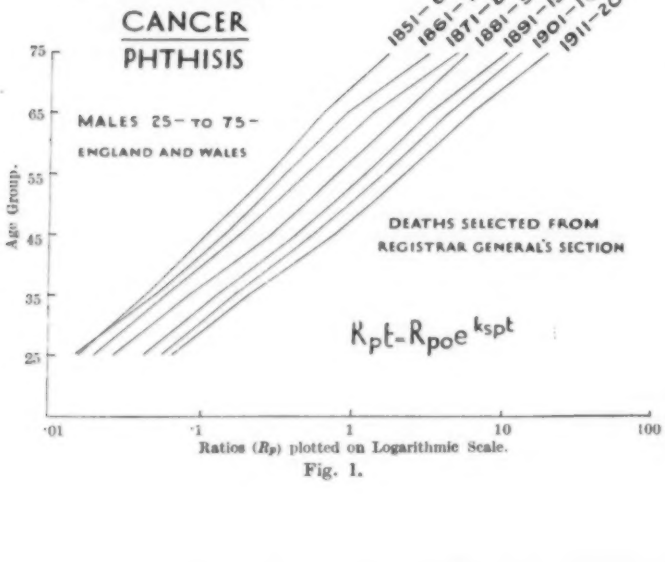



Fig. 1.

The log $R$ law holds for every county of England and Wales and shows systematic variations for the different social classes and for rural, urban and county borough districts.

Two types of ratio may be used:

$$\frac{\text{Cancer}}{\text{Tuberculosis}}\ (R) \text{ and } \frac{\text{Cancer}}{\text{Phthisis}}\ (R_P).$$

Similarly, two types of section may be chosen, the census unit and the Registrar-General's. For special reasons, the values of $k$ must be calculated from the $R$ values of a census unit section. From the value of $K_u$ thus obtained, the period of division of the phages ($\lambda$) twenty-five years to old age may be shown to be once in about every 4·5 years. The rate of division has slowly increased during the past century; this can be interpreted as a slowly increasing virulence of the 'cancer phage'.

A second constant of the curves is the 'equi-virulence group', that is, the age group at which $R = 1$. With advancing decennia, the age group at which $R$ is equal to 1 becomes progressively lower. This is a more pronounced change than the alterations

in $\bar{K}_M$, and is interpreted in the theory as due to increased numbers of phages within the bacillus (see below).

The essence of particulate multiplication in geometrical progression must be a discontinuous increase in $R$. This shows in the values of $R$ for lower age groups. From 0 to 3 years there is an approximate log $R$ law ($\lambda = 6$ months), but from five to twenty years, where $\bar{R}$ remains fairly constant, the verticals do not move progressively to the right in successive decennia but are bunched together into two 'stationary periods' (1851–61–71– and 1891–1901–11–) which are separated from each other by a distinct interval. This is perhaps the most striking new relation in support of the 'cancer phage' theory. (Fig. 2.)

To account for the geometrical progression, values of $R$ must be a direct function of the number of phages. Actually $R_x/R_{\min.}$ is the number of phages at $R_x$, and two independent methods of calculating $R_{\min.}$ give similar results. Using these, it appears that the number of phages present in the undissociated complexes by old age is tremendous.

If values of $R$ represent certain whole numbers (of phages), then the ratios of small determinate values of $R$ should be ratios of integers. These necessary conditions obtain at the stationary periods, where for males

$$\frac{\bar{R}_{\delta-}\ (1891\text{–}1901\text{–}11\text{–})}{\bar{R}_{\delta-}\ (1851\text{–}61\text{–}71\text{–})} = \frac{7}{2}\ \text{(actually 3·491)}$$

and for females

$$\frac{\bar{R}_{\varphi-}\ (1891\text{–}1901\text{–}11\text{–})}{\bar{R}_{\varphi-}\ (1851\text{–}61\text{–}71\text{–})} = \frac{5}{2}\ \text{(actually 2·506)}.$$

The various regions of the composite curves are named as follows: 0 to 3 years, period of free division; 5 to 20 years, period of arrested division; 20 to old age, period of symbiosis. There is a close correlation between the life-cycle of the complex and the age distribution of pulmonary and non-pulmonary tuberculosis. It is to be noted, too, that early in life, when $\lambda = 6$ months, sarcoma is the chief type of malignancy, while later in life, when $\lambda = 4{\cdot}5$ years, cancer largely replaces sarcoma.

It is hoped to publish full details of this work shortly.

D. BARRON CRUICKSHANK.

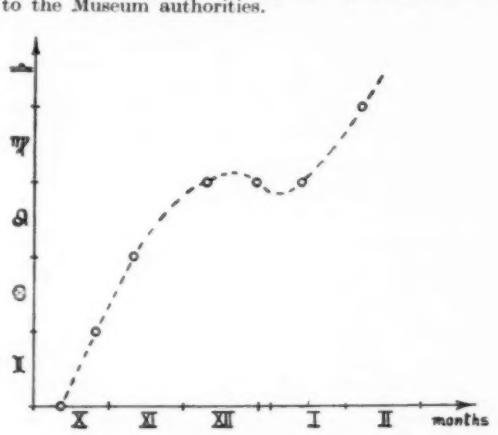
Simms Woodhead Memorial Laboratory,
Papworth, Cambridge.

[1] Cherry, T., *Med. J. Australia*, Oct. 11 (1924); June 6 (1925); Aug. 12 (1933).
[2] Cruickshank, D. B., "Tuberculosis, Cancer and Zinc. An Hypothesis" (Medical Publications, London, 1936).

## Egyptian Astronomy

WHILE we are very well informed about Greek and Babylonian astronomy, almost nothing was known of an Egyptian calculating astronomy until very recently. This situation, however, has been completely altered by the discovery and investigation of a number of Demotic texts. In the beautiful collection of Egyptian papyri belonging to the Carlsberg Foundation in Copenhagen, A. Volten found an astronomical text in the Demotic language which he and I have recently edited[1]. We were able to show that the text deals with a simple scheme for calculating the beginnings of the months depending on a period of 25 Egyptian years (one Egyptian year being 365 days, this is almost exactly equal to 309 synodical months[2]). This text belongs to such a late period as Antoninus Pius (*c.* A.D. 150), it is true; but there are several good reasons for assuming that the same methods were already in use in the Twelfth Dynasty (*c.* 1800 B.C.[3]). Thus we know the method by which the Egyptians predicted the phenomena of the moon.

Since then, further essential progress has been made in the understanding of other parts of Egyptian astronomy. Mr. Volten directed my attention to an almost forgotten paper of H. Brugsch[4], in which he investigated four wooden tablets acquired in 1853 in Egypt by the Rev. H. Stobart, correctly recognizing that these texts refer to the motion of the five planets. These tablets are now in Liverpool and, by the courtesy of the Director of the Museum there, I got excellent photographs of them, making a new investigation of all these texts possible. In this connexion, I would like to express my deep gratitude to the Museum authorities.




The principle of these planetary tablets is easy to explain by means of the following section[5] belonging to the movement of Mercury:

| | | | |
|---|---|---|---|
| year 8 | 10 | 11 | ♊ |
| | day | 25 | ♋ |
| | 11 | 10 | ♌ |
| | 12 | 9 | ♍ |
| | day | 29 | ♌ |
| year 9 | 1 day | 1 | ♌ |
| | day | 12 | ♍ |
| | 2 day | 6 | ♎ |

The meaning of these numbers is as follows: The years give the years of the reign of Vespasianus (year 9 is, thus, year A.D. 76), and the two following columns indicate the Egyptian months and days on which Mercury enters the different signs of the Zodiac. The only exception to this rule is the information given in the first line of every year. Here only the sign *inside* which the planet is standing on the new year's day is indicated.

To understand the text it is essential to recognize that the same tabulations contain also the *retrograde* entrances of the planet into a Zodiacal sign, a type of movement which manifests itself in the section above by the order ♌ ♍ ♌ ♍. The investigation of these texts becomes as simple as possible if we use a graphical representation showing the velocity of

the planet. Such a graph, for the case in question, is reproduced herewith. For example, this diagram shows without any calculation that the positions of the planet were only calculated theoretically (at least in part), because the point in the middle of the retrograde motion must coincide almost exactly with the inferior conjunction, and in such a position in front of the sun it is impossible to observe a star.

It is easy to date these texts exactly by means of astronomical calculation; we find that they belong to the interval between Vespasianus 3 (= A.D. 70) and Hadrian 17 (= A.D. 132). In addition to the Stobart tablets there is a Berlin papyrus describing the movement of the planets by the same method for the years 14 to 41 of Augustus[6]. I intend to publish elsewhere an extensive treatment of all these texts.

Finally, it may be remarked that Dr. H. O. Lange has deciphered an extremely interesting text, also belonging to the Carlsberg Collection, which treats the phenomena of the fixed stars (heliacal risings and settings, etc.). Thus in an unexpectedly short time we have got a comparatively thorough knowledge of Egyptian astronomy, so that it is now possible to compare Egyptian, Babylonian and Greek astronomy as, for a somewhat longer time, we have been able to compare these respective mathematical systems.

O. NEUGEBAUER.

Institute of Mathematics
and Institute of Egyptology,
University, Copenhagen.

[1] Neugebauer, O. und Volten, A., "Untersuchungen zur antiken Astronomie IV. Ein demotischer astronomischer Papyrus" (*Pap. Carlsberg* 9). "Quellen u. Studien zur Geschichte d. Mathematik, Astronomie u. Physik", Abt. B, **4**, 383–406 (1938).

[2] Cf. also "Almagest", **6**, 2 (ed. Heiberg, **1**, 464).

[3] Cf., for example, the calendar of temple duty from Kahun, *Z. aegypt. Sprache u. Altertumskunde*, **37**, 92 ff. (1899).

[4] Brugsch, H., "Nouvelles recherches sur la division de l'année des anciens égyptiens, suivies d'un mémoire sur des observations planétaires consignées dans quatre tablettes égyptiennes en écriture démotique" (Berlin, 1856).

[5] Tablet A (Tablet III of Brugsch), Rev. iii, 29 to 33, and Rev. iv, 30 to Rev. v, 2. The order in which Brugsch arranged the tablets has proved to be incorrect.

[6] Published (but only in part): "Demotische Papyrus aus den Kgl. Museen zu Berlin" (ed. W. Spiegelberg, Leipzig u. Berlin, 1902).

## The Expanding Universe and the Origin of the Great Nebulæ

IT is widely accepted that the system of great nebulæ is at present in a state of uniform expansion, the relative velocity of recession between any two members of the system being proportional to their mutual distance. Thus we can write $v = \alpha r$, where the coefficient $\alpha$ has, according to Hubble[1], the value $3 \times 10^{-17}$ sec.$^{-1}$. If we accept also the uniformity of expansion with time, that is, if we suppose that the relative velocity of any two nebulæ is constant, we can easily calculate that about $10^9$ years ago all nebulæ were side by side, that is, space was uniformly filled up with the stars. This epoch should thus be considered as the epoch of the formation of stellar accumulations known at present as great nebulæ.

Let us consider the necessary conditions for the formation of such condensations in an expanding, originally homogeneous, system of particles with the average mass $m$ (atoms or stars) and average 'thermal' velocity $v$. Condensations of this kind might be originated by the occasional fluctuations of density, supplemented by the mutual gravitational attraction of slightly condensed particles[2]. If $R$ is the radius of the original condensation, the necessary condition for its formation through occasional distribution of proper velocities of particles is evidently the requirement that the recession velocity on the surface should be smaller than the proper 'thermal' velocity of particles:

$$\alpha R < v, \qquad \text{or} \quad R < v/\alpha \qquad (1)\ (1')$$

As soon as such a rudimentary condensation is formed, the condition for its increase and stability will be given by the requirement that the gravitational potential on the surface is larger than the proper kinetic energy of its particles:

$$\frac{GMm}{R} = \frac{4}{3}\pi\rho R^2 Gm > \tfrac{1}{2}mv^2, \qquad (2)$$

or

$$R > v\sqrt{3/8\pi G\rho} \qquad (2')$$

Thus the radii of accumulations should be comprised between two limits. In order that the condensations may be possible at all, we evidently require that

$$\frac{1}{\alpha} > \sqrt{\frac{3}{8\pi G\rho}}, \text{ or } \rho > \frac{3\alpha^2}{8\pi G} = 1{\cdot}4 \times 10^{-27} \qquad (3)\ (3')$$

Since the present average density of matter in space is, according to Hubble[1], only of the order $10^{-30}$, the condition for clustering is evidently not satisfied at the present time. However, looking into the past, we find it was satisfied once upon a time. In fact, when all distances were $f$ times smaller, the average density was $\rho f^3$ and the value of $\alpha$ was $f$ times larger (on our hypothesis of uniform expansion in time). We write thus:

$$f^3\rho = \frac{3\alpha^2 f^2}{8\pi G}, \qquad (4)$$

from which $f \simeq 1{,}000$. Since the present average distance between the nebulæ is just about 1,000 times larger than their diameters, we conclude that the time of formation of nebulæ coincides with the time after which the formation of condensations became impossible. Thus our picture is as follows: At the early condensed state of the universe, the formation of all different sizes of condensation was taking place. With the progressing expansion, the limits of possible radii were more and more narrowed, and at a certain stage ($10^9$ years ago) the existing condensation of almost the same radius was dragged apart by expansion. From the present size of nebulæ (which we assume to be of the same order as their original size) we can now calculate the velocity $v$ of the particles, and it comes out of the order of magnitude 100 km./sec., that is, of the general order of stellar velocities. Thus it is natural to suppose that the particles we have been considering above were the stars or, in other words, the formation of stars took place before the formation of the great nebulæ. If, however, we suppose that the nebulæ were originally formed from the gas, 100 km./sec. should be the velocity of gas molecules corresponding to temperatures of several million degrees, which seems to be very unlikely.

We must point out here that our assumption of uniformity of expansion in time can be correct only for the open cosmological models with negative curvature[3]. The investigations of Hubble[1] seem to indicate, however, that the observed density-distribution of nebulæ in space shows thinning out at great distances, thus leading to positive curvature and a closed cosmological model. It should be mentioned, however, that the estimate of distances was made by Hubble on the hypothesis that the absolute luminosities of nebulæ remain constant. So far as we

can see very distant nebulæ in the earlier stages of their evolution, a slight decrease of total luminosity of a nebula with age will completely change the situation.

A more detailed account of this work will be given elsewhere.

G. GAMOW.
George Washington University. E. TELLER.
Dec. 15.

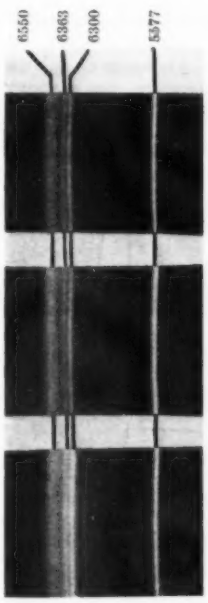
[1] Hubble, E., "The Realm of Nebulæ" (Yale Univ. Press, 1936).
[2] Jeans, J. H., "Astronomy and Cosmogony" (Cambridge Univ. Press, 1928).
[3] Tolman, R. C., "Relativity, Thermodynamics and Cosmology" (Oxford University Press, 1938).

## Red Auroral Lines on September 14–16

IN a letter entitled "Very Small Intensity of the Red O1 Triplet during the Auroral Displays of September 14–16", Vegard[1] has from his observations concluded that the intensities of the red auroral line 6300 A. and of the red positive group of nitrogen were very weak at that occasion.

Our photographs on Agfa Isopan *ISS* plates of the auroral spectra on those nights give a quite different result.[2]

On September 14–15, spectrograms were taken in continuous succession with three different spectrographs from 20h 45m M.E.T. until 3h 55m, simultaneously with photographic height measurements, from a series of stations. On *each of the* 17 *spectra* taken, the red auroral lines and bands are fairly strong, and on some of them, the line 6300 A. is several times stronger than the green auroral line 5577 A.




SPECTRA OF THE RED AND GREEN LINES OF THE AURORA OF SEPTEMBER 14–16, TAKEN ON AGFA ISOPAN *ISS* PLATES.

In the accompanying reproduction, *a* and *b* show the green and red parts of spectra taken simultaneously with the spectrum the photometer curves of which are given in Vegard's letter; *a* was exposed from 23h 18m until 23h 35m towards pulsating bands near Vega, *b* from 23h 43m until 24h 00m towards a red-green band in the north.

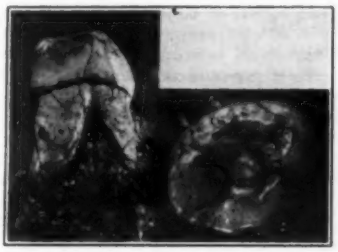
On September 15–16, nine spectra were taken, also simultaneously with height determinations. On each of them the red parts are very pronounced; *c* shows the red and green parts of a spectrum taken simultaneously with that taken by Vegard (see spectrum *b* in his letter) from 20h 47m until 21h 52m towards the summits of sunlit rays near the pole star.

CARL STÖRMER.
Institute of Theoretical Astrophysics,
Blindern, V. Aker.
Dec. 10.

[1] Vegard, NATURE, 142, 831 (1938).
[2] Störmer, NATURE, 142, 1034 (1938).

## Further Remains of a Sterkfontein Ape

THE discovery at Sterkfontein by Dr. Robert Broom of new fossil anthropoid apes has created such widespread interest that it is desirable to report immediately on all new evidence that may come to hand.



MESIAL AND OCCLUSAL VIEWS OF THE NEW TOOTH DISCOVERED AT STERKFONTEIN.

Since March 1934 I have been working in the Sterkfontein district and have been fortunate enough to secure a number of new species of fossil mammals. Early in the present month (December) I discovered on the farm of Mr. Cooper, near the Sterkfontein Caves and about a quarter of a mile away from where Broom's first skull was discovered, a beautifully preserved tooth which differs in many respects from, but yet has certain characters of the same order as, those revealed by some of the upper molars of *Plesianthropus transvaalensis* and *Paranthropus robustus*.

The tooth is an upper left third molar. Its crown measures 13 mm. mesio-distally and 15 mm. bucco-lingually and its occlusal surface shows little indication of the wrinkling which is such a conspicuous feature of the corresponding molar in Broom's skulls. The crown is triangular in form with the base represented by the mesial side and the angles rounded off. This form is due primarily to marked reduction in the size of the metacone. Compared with the size of the crown, the masticating surface is small. Many of the detailed characters of the grooves and ridges bring to mind conditions shown in the upper molars of *Sinanthropus*. As yet the roots are not completely cleared from their matrix, but sufficient has been done to permit measurement of the height of the tooth from the summit of the paracone to the end of the mesio-buccal root. This measurement equals 21 mm.

It would be unwarranted at this stage to conclude that the tooth represents a different species from either *Plesianthropus transvaalensis* or *Paranthropus robustus*. If, however, it belongs to one of these apes, it is evident that there was very considerable variation in the form of the third molars. I consider the tooth now discovered to be more human-like than the corresponding teeth reported on by Broom, but feel that when assessing the significance of the characters presented both by this tooth and the anthropoid teeth previously discovered at Sterkfontein, it will be necessary to give very close attention to the subject of normal variation of teeth.

J. C. MIDDLETON SHAW.
University of the Witwatersrand,
Johannesburg.
Dec. 8.

## Resonance in the External Auditory Meatus

IN investigations on the extent to which objective tests can be used to obtain information on the magnitude of the effective amplification hearing aids give to a deaf user, a knowledge of the extent to which resonance occurs in the auditory meatus is of value. In normal human beings such a resonance occurs in the region of 2,000–3,000 cycles per second and to some extent accounts for the shape of the minimum threshold hearing curve as the frequency is varied. It is possible to calculate the magnitude of the resonance from results of mechanical impedance measurements at the opening of the meatus and to demonstrate its existence by means of a probing pressure microphone which indicates increase of pressure as the probe approaches the tympanic membrane. The method has limits, however, and in addition to being inconvenient can cause damage if extreme care is not taken.

Recently a method has been used which permits the measurement of the magnitude of resonance without the introduction of a measuring device into the meatus. It consists in replacing the air in the meatus by some other gas in which the velocity of sound $V$ differs from that in air ($V = 332$ metres per second). The method uses a moving coil telephone receiver which has two tubes of narrow bore inserted through the periphery of the earcap. The receiver is held comfortably in position on the ear by means of a springy headband, the cap of the receiver being covered by rubber to reduce leakage to the external air. One of the tubes is connected to a cylinder of hydrogen ($V = 1{,}261$ metres per second) and the other tube left free to the external atmosphere. When hydrogen is allowed to pass at a slow rate, by means of a reducing valve, the air in the meatus can be displaced by hydrogen in quite a short time (a minute or so). If the receiver is connected to an attenuator operating on the output of an audio-frequency oscillator, hearing measurements can be made either at threshold or by aural balancing, and the effect of interchange of air and hydrogen quickly determined.

It is found that at frequencies below about 2,500 cycles per second the introduction of hydrogen reduces the intensity level of the sound, the reduction reaching a maximum of about 12 decibels at 2,500 cycles per second. As the frequency is raised further it is found the intensity level first increases as the hydrogen enters, reaches a maximum and then diminishes, while at a frequency in the region of 6,000 cycles the final level is equal to that with air in the meatus. At a frequency of about 9,000 cycles per second, the introduction of hydrogen raises the sound-level by about 9 decibels and at higher frequencies the effect diminishes rapidly to that of a reduction again. The resonant frequencies are not quite in the same ratio as that for the two velocities of sound (3·8/1) nor is the increase in level at 9,000 so high as the decrease in level at 2,500 cycles per second. This may indicate that the substitution of a lighter gas in the ear disturbs what might be an optimum reduction factor for the ossicular chain between the tympanic membrane and the oval window, so that there is an overall loss of efficiency due to the change. The initial increase and final decrease in the sound-levels shown in the region from 2,500 to 6,000 cycles indicate that resonance is occurring for air-hydrogen mixtures having values for the velocity of sound intermediate between those for air and hydrogen.

Similar results have been obtained with coal gas ($V = 500$ metres per second), where the two resonant frequencies are closer together, except that the reduction at the air resonant frequency is only about 10 decibels.

The experiments show that there is quite an appreciable pressure magnification (about three times) due to meatus resonance. The flatness of the resonance indicates that energy is absorbed by the material and mechanism of the ear. Undoubtedly some of this energy is consumed in overcoming viscous forces in the middle and inner ear and some of it may be transformed into electrical form in the inner ear.

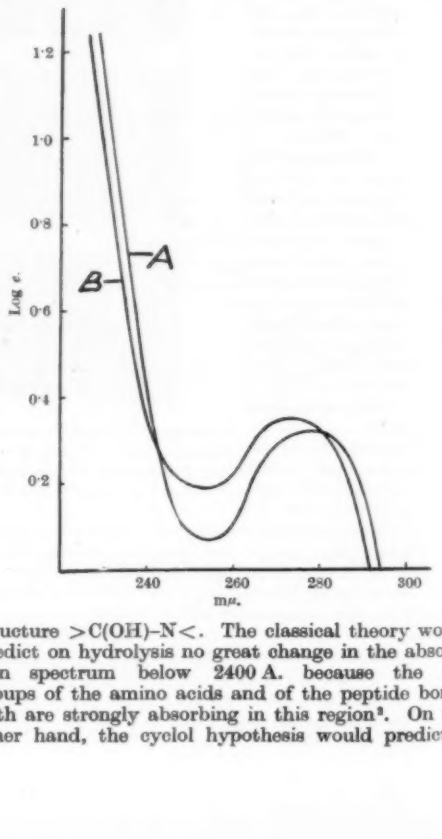
In addition to the above usage, filling the meatus with hydrogen suggests the possibility of reducing hearing by air conduction near the resonant frequency without corresponding reduction in bone conduction, so far as distant sounds are concerned.

T. S. LITTLER.

Dept. of Education of the Deaf,
The University,
Manchester.
Dec. 14.

## Ultra-violet Absorption of Genuine and Hydrolysed Protein

ACCORDING to the classical theory of protein structure, the carboxyl and amino groups found after hydrolytic splitting of a protein come from –CO–NH– bonds. According to the cyclol hypothesis (Wrinch[1]), however, the free carboxyl and amino groups must be formed, during the splitting, from bonds of the




structure >C(OH)–N<. The classical theory would predict on hydrolysis no great change in the absorption spectrum below 2400 A. because the CO groups of the amino acids and of the peptide bonds both are strongly absorbing in this region[2]. On the other hand, the cyclol hypothesis would predict a

greatly increased absorption because of the formation of new CO groups.

We have now compared the absorption spectrum of a genuine serum globulin (ox) with the same protein in the hydrolysed state. 15 c.c. of a salt-free dialysed 4·4 per cent suspension of globulin was dissolved in 180 c.c. $n/12$ $NH_4OH$–$NH_4Cl$ (*p*H 8·9) and sterilized by passing through a Berkefeld filter. To 65 c.c. were then added 45 c.c. of a sterilized 0·17 per cent trypsin solution (Merck) and the mixture (*A*) was left at 0° C. for 72 hours. Genuine serum-globulin is not digested by trypsin, and therefore another sample (65 c.c.) was denatured in a closed bottle 20 min. in a boiling water-bath. After cooling, *p*H was the same as before. 45 c.c. of the trypsin solution was added and the mixture (*B*) left at 39° C. for 72 hours. Sulphosalicylic acid gave then with *A* a large amount of precipitate, but with *B* only a faint opalescence. The ultra-violet absorption spectra of solutions *A* and *B* are shown in the accompanying figure.

The absorption for genuine (*A*) and for hydrolysed (*B*) protein is about equal. This seems to be in greater accordance with the classical theory on the structure of proteins than with the cyclol theory.

Some of the exposures were made at the Hygienic Institute of the University. For this favour we wish to thank Prof. Fridericia and Mr. Behrnts Jensen.

FELIX HAUROWITZ.
TAGE ASTRUP.

Biological Institute,
Carlsberg Foundation,
Copenhagen.
Dec. 2.

[1] Wrinch, D. M., NATURE, 139, 798, 972 (1937).
[2] Cf. Magill, M. A., Steiger, R. E., and Allen, A. J., *Biochem. J.*, 31, 188 (1936).

## Mechanism of the Oxidation of Reduced Coenzyme I

THE oxidation in animal tissues of metabolites such as lactic, malic and triosephosphoric acids may be resolved into three component reactions:

(1) Metabolite + coenzyme I → oxidized metabolite + reduced coenzyme I.

(2) Reduced coenzyme I + carrier → coenzyme I + reduced carrier.

(3) Reduced carrier + oxygen → carrier.

It was recently discovered[1,2] that animal tissues contain coenzyme factor (diaphorase), an enzyme which specifically catalyses reaction (2). The chemical nature of the enzyme was not known. The flavoprotein isolated by Straub[3] from heart muscle also catalyses reaction (2) and its properties have convinced us of its identity with the coenzyme factor. Under optimal conditions one molecule of flavoprotein catalyses the oxidation of 8,500 molecules of reduced coenzyme I per minute at 38° ($Q_{O_2}$ = 180,000). The catalytic efficiency and the concentration in tissues of this new flavoprotein are sufficiently high to permit the conclusion that it takes a fundamental role in cellular respiration.

Muscle flavoprotein does not undergo a cycle of oxidation and reduction in the course of its catalysis and therefore cannot act as an intermediate between reduced coenzyme and molecular oxygen. There is evidence that under physiological conditions flavoprotein catalyses the reaction between reduced coenzyme and molecular oxygen via the cytochromes.

Coenzyme factor is present in almost every animal tissue and in several micro-organisms[4]. Correspondingly the amount of the flavin-adenine dinucleotide, that is, the prosthetic group of this flavoprotein, is found to be proportional to the amount of coenzyme factor present in the various sources.

F. B. STRAUB.
H. S. CORRAN.
D. E. GREEN.

Molteno and Biochemical Institutes,
Cambridge.
Dec. 17.

[1] Adler, Euler and Hellstrom, *Sr. Vet. Akad. Ark. Kemi*, 12, 1 (1937).
[2] Dewan and Green, *Biochem. J.*, 32, 626 (1938).
[3] Straub, NATURE, [143, 76 (1939)].
[4] Green and Dewan, *Biochem. J.*, 32, 1200 (1938).

## A Roman Water Pipe

THE methods used by the Romans in making their lead water-pipes have been described in detail by Lanciani[1] and Gowland[2]. Briefly, a cast sheet of suitable width is bent around a former, so that the edges come together; the inside is then filled with sand, or similar material, a temporary dam is built on either side of the seam and the welding is effected autogenously by means of molten lead or, occasionally, solder. Cross-sections of pipes, when etched in the ordinary way, betray their mode of fabrication, the coarse, crystalline structure of the weld-metal being particularly noteworthy.

ROMAN LEAD WATER PIPE. MICROGRAPH, NATURAL SIZE.

A pipe from the Roman baths at Augst, near Basel, recently examined by me, was exceptional, in that the weld-metal was extremely fine-grained (see accompanying photograph). Its position and the sharpness of the junction with the pipe-metal seemed to preclude the idea that the fineness of grain was due to deformation of the metal, and this was confirmed by the observation that the fine grain persisted after melting and re-casting. On analysis, the weld-metal was found to contain 0·08 per cent of copper (tin absent) and the sheet- or pipe-metal, 0·11 per cent of copper and 0·06 per cent of tin.

The explanation of the structure is now clear in the light of the experimental work, recently published, of Mr. Brinley Jones[3], and of some additional information kindly supplied by him. It appears from this that castings of lead containing less than 0·06 per cent of copper (the eutectic proportion) are coarsely crystalline, whereas a higher percentage of copper produces a refined structure, owing presumably to the initial separation of a cloud of minute copper particles, which act as nuclei for the growth of lead crystals. It is essential that cooling should be fairly rapid, so that the copper particles are trapped in the alloy and do not float to the surface, and also that tin should be completely absent. The last condition explains satisfactorily why the pipe metal, though hyper-eutectic in composition, is of unrefined grain.

The useful properties of the metal are dependent, in no small measure, upon the fineness of grain, and I learn from Mr. Brinley Jones that practical use of these lead-copper alloys of fine grain is being made. It will undoubtedly be a source of satisfaction to those who seek application of these alloys to know that they can reckon on the persistence of the fine grain, at atmospheric temperatures, for at least eighteen centuries.

J. A. SMYTHE.

King's College,
Newcastle-on-Tyne.
Dec. 12.

[1] Lanciani, "Le Acque e gli Acquedotti", 194 (1880).
[2] Gowland, *Archæologia*, 414 (1891).
[3] Brinley Jones, *J. Soc. Chem. Ind.*, 251 (Aug. 1938).

## Fractures of Reversed Fault Type Produced in Concrete by Torsion

EXPERIMENTAL tests on concrete are frequently of interest to the geologist, since concrete is a brittle material and possesses physical characteristics similar to those of certain rocks. Its behaviour under load, and in particular under breaking load, may therefore throw light on the interpretation of structural phenomena in geology.

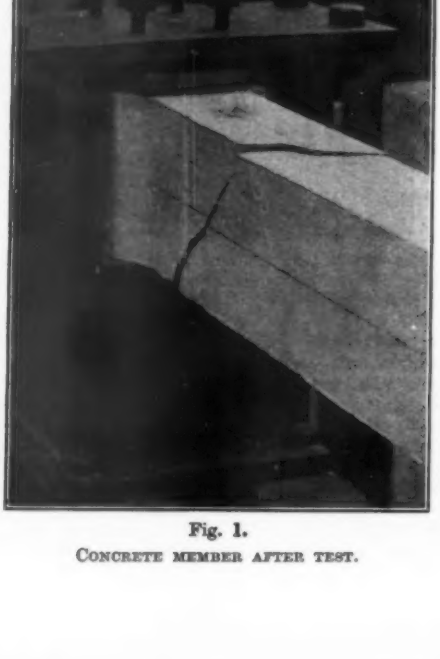


Fig. 1.
CONCRETE MEMBER AFTER TEST.

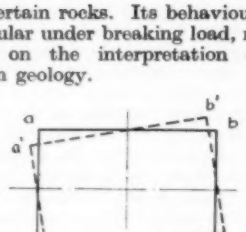



Fig. 2.
END ELEVATION OF MEMBER, SHOWING RELATIVE ROTATION OF FRACTURE-SURFACES.

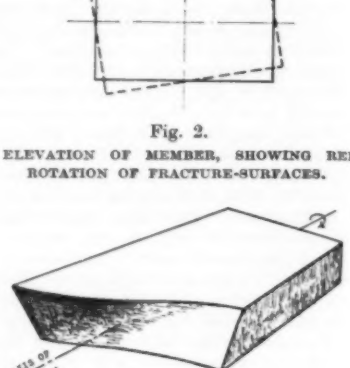



Fig. 3.
CURVED FRACTURE-SURFACE.

With the object of determining the torsional rigidity of plain concrete members, a number of experiments were recently carried out by a research student, Mr. N. Tembe, working with us in the Civil Engineering Laboratories of the City and Guilds College. The majority of the members were 4 ft. in length and 6 in. × 4 in. in cross-section, except for a distance of 6 in. at the ends, where the section was 6 in. × 6 in. In addition, some members of circular and of Tee-section were tested.

The concrete was composed of 1 part by weight of cement, 2 parts of fine aggregate (Stone Court sand) and 4 parts of coarse aggregate ($\frac{3}{4}$ in. Thames ballast), the water-cement ratio being 0·55. Two special members were made of mortar consisting of 1 part by weight of cement to 3 parts of Stone Court sand, thus producing a mortar approximating to a natural sandstone or grit in grade composition. Specimens were stored for seven days in moist air before they were tested.

One end of a member was gripped in the fixed 'chuck' of a specially designed testing machine, and the other in the rotating 'chuck' to which the torque was applied. The torque-strain curve for the members was linear, the modulus of rigidity determined from the tests being $2{\cdot}25 \times 10^6$ lb./sq. in. Immediately before failure occurred the twist on a gauge length of 30 in. was approximately $1\frac{1}{2}°$. Failure occurred suddenly by the formation of a tension crack of roughly spiral form, at 45° to the plane of twisting, and immediately after failure there was a relative angular movement of the separated sections of about $2\frac{1}{2}°$ (Fig. 1).

The outstanding features of the failures, namely, the tension crack and the relative angular movement, were observed in every test. The members made of mortar, mentioned above, behaved in a similar manner; members of circular cross-section showed a more perfect spiral fracture. Fig. 2 shows in end view the type of displacement, the side *ab* being moved to *a'b'*, and Fig. 3 illustrates the curved fracture-surface.

The trace of the fracture-surface on each long face of a test member was inclined at an angle of about 45° to the length of the face. The surface of the fracture was not normal to the face, but had a varying inclination (Fig. 3) and sloped in opposite directions on either side of the centre line of the face. Thus in a broken member, each of the fracture-surfaces, on account of its curvature, consisted of a 'hanging wall' on one side of the axis of torsion, and a 'footwall' on the other side of the axis, to use the terminology applied to faults. When fracture took place, the 'hanging wall' was in each case *raised* with respect to the 'footwall'.

The concrete broke in tension, but owing to the fact that this was produced by torsional loading, the separation of the two parts involved the motion described above, which would correspond to that of a pivotal reversed fault if it occurred under geological conditions. In text-books of geology, reversed faulting has generally been attributed to compressional forces. A brittle stratum or series of strata in Nature, however, might be subjected to torsional loading, for example, through unequal settlement over an area; the torsional axis in this case would be horizontal (or nearly so). It is suggested that such a loaded stratum would then be likely to break in tension, in a similar way to that seen in the tests described.

F. G. H. BLYTH.

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W. T. MARSHALL.

Civil Engineering Department,
Imperial College of Science and Technology,
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Nov. 20.

## Jędrzej Śniadecki (1768–1838) on the Cure of Rickets

IT is a view generally accepted that the English physician, Dr. T. A. Palm, first directed the attention of the scientific world to the curative effect of sunlight on rickets. L. J. Harris[1], when dealing with the frequency of the occurrence of rickets in relation to the climate, writes: "The explanation was given by an English medical man, Dr. T. A. Palm, in 1890. He it was who first pointed out that rickets is prevalent wherever there is little sunlight and unknown or comparatively rare wherever sunshine is abundant".

In connexion with the view expressed above, it seems of interest to quote an opinion of Jędrzej Śniadecki about the methods of curing rickets. Jędrzej Śniadecki was a Polish physician and physiologist and professor of chemistry at the University of Wilno. He was the first to introduce into Polish science Lavoisier's then new ideas. The hundredth anniversary of his death was celebrated this year by Polish men of science. In his book "On the Physical Education of Children", written in 1822, Śniadecki says in the chapter on "English Disease"[2]: "If the parents' financial status permits, it is best to take the children out into the country and keep them as much as possible in the dry, open and pure air. If not, at least they should be carried about in the open air especially in *the sun, the direct action of which on our bodies must be regarded as one of the most efficient methods for the prevention and the cure of this disease.* . . . Thus strong and obvious is the influence of the sun on the cure of the English disease, and the frequent occurrence of the disease in densely populated towns, where the streets are narrow and the dwellings of the working-class people low and very poorly lit."

From the passages quoted above it is quite clear that J. Śniadecki fully realized the significance of the sun both in prevention and cure of rickets.

W. MOZOŁOWSKI.

Institute of Physiological Chemistry,
Stefan Batory University,
Wilno.
Dec. 12.

[1] Harris, L. J., "Vitamins in Theory and Practice", 110 (Cambridge, 1935).
[2] Śniadecki, Jędrzej, "Dzieła", vol. 1, 273–274, Warszawa (1840).

## Marine Turtles as Current Indicators

IN a letter recently published in NATURE[1], my friend Mr. Paul Deraniyagala directed attention to the fact that Kemp's loggerhead turtle, the normal range of which appears to be the Mexican Gulf neighbourhood, occasionally finds its way to the shores of the British Isles; he suggests that: "The possibilities of sea turtles as current indicators would thus appear to be considerable . . ."

A favourable opportunity to test this hypothesis has quickly presented itself, for there has been an unusual number of turtles stranded on the British coasts during the first eighteen days of December. Seven, in all, have been reported. Four of them (two at Bognor, one near Tenby and one on Selsey Bill) were common loggerheads, *Caretta caretta* (Linn.); the others (one at St. Ives, one near Charmouth and one at Bexhill) have not been identified.

Exactly whence they may have come is uncertain, since turtles occur in the tropical and sub-tropical waters on both sides of the Atlantic; but they must have come from that ocean, and it is difficult not to associate their coming with the remarkably warm weather and almost uninterrupted series of south-westerly gales which characterized late November and early December. It seems probable that there has been a strong in-drift of warm surface water into the English Channel from the south-west, but whether there has been that inflow of true Atlantic water which seems so essential for the rehabilitation of the West Country fisheries remains to be seen.

H. W. PARKER.

British Museum (Natural History),
London, S.W.7.

[1] NATURE, **142**, 540 (Sept. 17, 1938).

## Reproduction of the Dogfish

IN the course of a recent investigation, I have found that:

(1) Migration of ova from the ovary to the cœlomic opening of the oviducts in *Scylliorhynus canicula* is entirely dependent upon ciliation, as it is in Amphibia[1].

The entire peritoneal wall and many abdominal viscera of an adult female are ciliated. The cilia, which are absent in the male and immature female, direct a current of cœlomic fluid towards the ostium. An ovum excised from the ovary of one adult female and inserted through an abdominal incision into the peritoneal cœlom of another will undergo migration towards the ostium. The speed of the migration depends upon the region into which the ovum is introduced. An ovum placed in the bridge joining

the two liver lobes will traverse the hepatic sinus, enter the ostium and descend an oviduct as far as the top of the oviducal gland, in three hours. There are no muscular movements of any of the organs concerned.

(2) In addition to its function of secreting albumen and the egg-case, the oviducal gland of the dogfish is a receptaculum seminalis. By triturating a portion of the shell secreting zone of the gland in saline solution, active spermatozoa can be seen at all times of the year. There does not seem to be any sharply defined breeding season, but an increase in breeding activity is noticed in the spring. The oviducal glands of all adult females contain spermatozoa, but the sperm content is very variable. In preparations of resting glands, spermatozoa can be seen in the shell-secreting tubules, whilst in actively secreting glands, a proportion of these spermatozoa are emitted in the shell material. In this way fertilization of an ovum is practically ensured.

A detailed account of this work will appear later.

H. METTEN.

Biology Department,
Medical College,
St. Bartholomew's Hospital,
Charterhouse Square, E.C.1.
Dec. 13.

[1] Rugh, R., *J. Exp. Zool.*, **5**, 71, No. 1 (July 5, 1935).

### Kinetic Regions in Chromosomes

I HAVE previously disavowed any deeply founded conviction concerning the name applied to the kinetic region which, in one form or another, seems to be present in most chromosomes. The first thing needful is agreement on such a name, and then the abandonment of the ten or more other names now in use. I proposed the adoption of the word 'kinetochore', partly because it seems at least as good as any now in use and also because Sharp has employed it in a rather widely used book. But at about that time the term 'centromere' was used by Darlington, and British workers have accepted it quite generally. I should like to point out that not only is thereby added another to the long series of words that already have caused much confusion ('centrosphere', 'centrodesmus', 'centrosome', 'centriole', 'central body', etc.); but that the word 'centromere' was coined by Waldeyer in 1903 to designate the neck region of the spermatozoon. Since it seems certain that many future investigations will concern themselves with the chromosome region in question, I propose that an entirely new name be adopted if the word kinetochore be considered unacceptable.

FRANZ SCHRADER.

Department of Zoology,
Columbia University.

## Points from Foregoing Letters

GRAPHS showing the relation between the incidence of cancer and of tuberculosis in different age groups are submitted by D. Barron Cruickshank. The author connects these with a theory which postulates the existence of a *Bacillus tuberculosis* 'phage' which causes cancer, the relative tendency of the hypothetical 'complex' of bacillus and 'phage' to break down determining how many persons die of cancer and how many of tuberculosis in any age group.

By deciphering an astronomical text in the Demotic language now at the Carlsberg Foundation in Copenhagen, and other texts in the Liverpool Museum, Prof. O. Neugebauer has elucidated some of the methods used by the Egyptians in their astronomical calculations. The texts refer to the dates in which the planet Mercury entered the different signs of the Zodiac and astronomical calculations show that they belong to the period A.D. 70–132; the same methods were probably in use at much earlier periods.

Assuming that the Universe has been uniformly expanding with time, Dr. G. Gamow and Dr. E. Teller calculate that the existing nebulæ were dragged apart about one thousand million years ago. Up to that time the nebulæ had been together as part of a non-expanded Universe, consisting of particles having a velocity of about 100 km./sec. (of the same order of magnitude as the velocity of the stars, with which the 'particles' may be identical).

Prof. C. Störmer submits photographs of auroral lines taken on September 14–16. Unlike those reported by Prof. Vegard the red auroral lines are fairly strong and in one instance stronger than the green line.

The discovery of a well-preserved upper left third molar at Sterkfontein, South Africa, more human like than the corresponding teeth described by Broom, is reported by Prof. J. C. Middleton Shaw.

A method of determining the magnitude of the resonance occurring in the external auditory meatus is described by Dr. T. S. Littler. A gas (hydrogen or coal gas) in which the velocity of sound is different from that in the air, is introduced in the meatus, and the change in the intensity level of the sound at different frequencies is observed. An appreciable pressure magnification (about three times) due to meatus resonance was found.

According to F. Haurowitz and T. Astrup, the ultra-violet absorption of genuine and hydrolysed protein seems to be in greater accordance with the classical theory than with the cyclol hypothesis.

Dr. F. B. Straub, H. S. Corran and Dr. D. E. Green have shown the identity of coenzyme factor and the flavoprotein isolated from heart muscle by Straub. This flavoprotein appears to be the normal physiological agent for catalysing the oxidation of reduced coenzyme I.

A photograph of a cross section of a Roman lead water pipe welded by means of lead containing 0·08 per cent copper is submitted by Dr. J. A. Smythe. Owing to the copper percentage being higher than the eutectic proportion, the weld shows a fine grained structure, which has persisted for 18 centuries.

# Research Items

## East Greenlanders in Olden Times

THE late Knud Rasmussen for many years had contemplated writing an account of the inhabitants of East Greenland before their mode of life had been modified by contacts with civilization, and for this purpose had collected much information, both by personal observation on his expeditions to Greenland, and by conference and correspondence with Christianized Eskimo. His notes and draft for such a work have been edited and published posthumously by H. Ostermann (*Medd. om Grønland*, København, 109, 1; 1938). A topographical record of Eskimo settlements in East Greenland, taking Angmagssalik as its centre, is followed by studies of Eskimo philosophy, religious and magical beliefs, and of East Greenland words, names and expressions. The trading station known as Angmagssalik was called by the Eskimo Tasiussaq, the former name being applied to the whole of the great ford, which extends far into the country, on account of the small fish *angmagssaq*, caught there and there only, to serve as part of the provision for the winter. The inhabitants of this dangerous and inhospitable part of Greenland lived by hunting, the staple of their subsistence being the seal; but they also hunted the bear and, in a lesser degree, other game. If the seal failed them, they ran the risk of starvation; and on occasion so many as fifty per cent of a settlement have perished from this cause, while others have saved themselves by cannibalism, the bodies of those who died being eaten, or, as in certain instances is orally recorded, murder being committed for the sake of the flesh of the victims. While the weather was sufficiently warm to dry the pelts, seals were flensed so as to preserve the skin whole; when dry it was used for the storage of blubber, in which fragments of the meat were preserved—a great dainty. As the weather grew colder, the carcasses were stored whole in the open, the extremities being covered with stones to keep the dogs away. Carcasses preserved in this way might not be eaten for six months, the higher the degree of putridity, the greater the appreciation of those who partook. When the carcase of a seal was brought in to be eaten, all the members of the community shared, the hunter's wife dividing it up, and he and his family usually securing the least share.

## Archæology of Eastern Tennessee

IN view of the forthcoming inundation of an area of 56 square miles to the height of the 1,020-foot contour by the building of dams by the Tennessee Valley Authority, it was decided in 1934 to make an archæological survey of the Norris Basin in eastern Tennessee—an area of especial importance for the prehistory of American culture, as the river valley and fertile bottomlands had furnished ideal sites for the rudimentary agriculture of aboriginal man. A report on the results of the survey has been made by Mr. William Webb, who acted as supervising archæologist for the Tennessee Valley Authority (Smithsonian Institution, Washington, *Bull.* 118; 1938). The survey revealed 23 sites showing definite evidence of prehistoric occupation. On these sites there were 20 earth mounds, 9 stone mounds, 4 village sites and 7 caves. Of the 29 mounds, 12 were burial mounds and 17 were associated with prehistoric structures. The sites investigated fall into four or five major divisions, of which the stone mounds had been previously excavated and being largely destroyed, furnished little in the way of archæological data. The cave sites afforded evidence of occupation by a rather primitive people, who buried their dead in or under midden debris on the cave floor. Bodies were usually fully flexed, without artefacts. Bone and shell were used extensively to make simple artefacts. A few burials were after partial cremation elsewhere. These sites seem similar to sites in eastern Kentucky, and with them present similarities to the later components of the Stallings Island complex. The burial mounds in earth have fully flexed skeletons without artefacts. Two are characterized by bundle burial of bones. Of the earth mound and village sites, all with one exception show evidence of rectangular post-mold patterns of dwellings and 'town-houses'. The culture traits here fall definitely into two groups, one showing 'small-log' construction and the other 'large-log' construction. It is suggested, speculatively, that these two cultures are those of people precedent to the Cherokee, by whom elements of the culture were adopted. The early 'large-log' people may be Creeks, while the 'small-log' people were connected with the Creeks by association rather than affinity, and may have been the problematical Yuchi.

## Storage of Oranges

PAMPHLET No. 80 of the Australian Council for Scientific and Industrial Research, which has just been issued, contains the results of co-operative work carried out by the Council, the Victorian Department of Agriculture, and the Biochemistry School of the University of Melbourne, and discusses the storage of oranges with special reference to locality, maturity, respiration and chemical composition. High-temperature treatments are not effective in controlling mould development in Washington Navel oranges, but there are indications that such treatments render the fruit less susceptible to mechanical injury and to subsequent low-temperature disorders. Mould development in uninjured oranges is a normal disorder of senescence, and any method which aims at its control should be directed towards delaying the senescence of the fruit. Washington Navels picked in early June in the early districts remained palatable for twelve weeks at 40–42° F., and for a further week at atmospheric temperatures. If the fruit was left on the tree longer, the life in cool storage was reduced by an equivalent period. The length of storage life and the rate of progress towards senescence was similar in fruit picked on the same date from both early and late maturing districts, but the oranges took longer to become palatable in the latter case. The development of colour and flavour and loss of acidity were retarded by removal from the tree, whereas progress towards senescence was the same whether the fruit was gathered or not. Palatability was found to depend on the composition of the juice, but respiration and storage life were more closely related to the constituents of the rind. Respiratory activity varied

considerably with the type of orange, that for Washington Navels increasing four times for a rise in temperature of 10° C., whereas in the case of the Valencia late orange the increase was only 2·4 times.

### Outer Regions of the Earth's Core

IN a preliminary attempt to investigate this region of the earth, B. Gutenberg has considered (*Bull. Seis. Soc. Amer.*, **28**, No. 3, July 1938, p. 197) the wave *SKS*, also known as $S_cP_cS$ or [*S*]. This is a wave which starts at an earthquake epicentre as a transverse pulse, *S*, is transformed as it reaches the earth's core to a longitudinal pulse, *P*, proceeds through the core as a *P* wave, is transformed again at the boundary of the core to an *S* wave and proceeds thus to the station where it is received. The travel time of an *SKS* wave thus depends much on the velocity in the outer part of the core. It is found that the graph obtained by plotting distance, measured in degrees, between the station and the epicentre, against the time of travel of this pulse, begins somewhere between 65° and 90° on the travel time graph of the $S_cS$ wave, that is, an *S* wave reflected once at the outer core of the earth, and that the first segment of *SKS* is below $S_cS$. It is thought that *SKS* has a focal point at some distance between 70° and 80°. The extreme values of the velocities of the longitudinal wave in the outer core of the earth appear to be 8·0 and 7·4 km./sec. respectively, though more detailed investigations are proceeding.

### Rate of Faulting near an Earthquake Epicentre

AN earthquake which has a surface focus might conceivably have a point focus causing subsequent faulting, or might have a line focus, simple or complicated by having the faulting take place synchronously with the initial time of the shock. The former appears, *a priori*, to be the most probable, since the faulting, due to resistance, takes an appreciable time to complete. Taking the former as a hypothesis, Hugo Benioff initiates (*Bull. Seis. Soc. Amer.*, **28**, No. 2, April 1938) an instrumental method of determining the rate of faulting and applies it to determine the extent of faulting in the Long Beach earthquake of March 10, 1933, this faulting being invisible at the surface. In a simple vertical fault in which the displacement is perpendicular to the direction of extension, the faulting impulse is considered to be propagated by shear waves. Thus the shear waves from the end-point can never arrive earlier than the wave from the focus. This does not apply where the displacement is parallel to the direction of extension. On these considerations an observed early arrival of *S* indicates that the source is a fault movement in which the displacement is parallel to the direction of extension. This conception can be applied variously, but in the Long Beach earthquake the available evidence indicates that the faulting extended from the focus $\lambda = 117°\ 58'$ W., $\varphi = 33°\ 36'$ N., approximately to Signal Hill, a distance of 27 km. with a faulting speed in the neighbourhood of 4·2 km./sec.

### Infra-Red Absorption of Carboxylic Acids in Solution

M. M. Davies and G. B. B. M. Sutherland (*J. Chem. Phys.*, **6**, 755; 1938) have investigated at 18° and 75° solutions of acetic, benzoic and trichloracetic acids in carbon tetrachloride at the three regions of the spectrum where absorption arises from the O—H, C—O and C=O bonds of the carboxyl group. In each region, double bands appear, one due to the monomeric and the other to the dimeric form of the molecule, and the separation is so small that it suggests that very little change is brought about in the molecule by association. The intensities of the O—H bands of acetic and benzoic acids increase with rise in temperature, indicating a preponderance of monomeric molecules at the higher temperature, thus corresponding with the behaviour of the O—H band of alcohols on rise of temperature. Trichloracetic acid gives a shift to longer wave-lengths on increasing temperature, suggesting that the O—H bond in this molecule is weaker, in agreement with its behaviour as a stronger acid than acetic. Essentially similar results have been obtained for the other bonds. Different concentrations of acid have been examined, and bond distances for each of the three bonds have been estimated. The same authors (*ibid.*, p. 767) have shown that the integrated intensity of the monomeric O—H and C=O bands give heats of association less than the accepted values, and this is attributed to variation in the absorption coefficient with temperature. In a third paper (*ibid.*, p. 770), Davies has found that ω-hydroxyundecanoic acid in carbon tetrachloride at 74° gives two sharp bands at 2·755 μ and 2·835 μ, corresponding respectively with the alcoholic and carboxylic O—H absorption. From the integrated absorption, estimates of the molar concentration of free O—H groups of each type have been made, and the proportion of free carboxylic O—H is less than that of free alcoholic O—H. The various possible dimeric associations are discussed, and it is shown that, in addition, intramolecular interaction must occur with formation of a cyclic monomer which exists in equilibrium with the open chain monomer.

### Nuclear Spin of $^{15}N$

ACCORDING to Fermi-Dirac statistics, $^{14}N$—$^{14}N$ should have even-numbered rotational lines strong, whereas in $^{15}N$—$^{15}N$ they should be weak. Two attempts to determine the spin of $^{15}N$ have just been reported. R. W. Wood and G. H. Dieke (*J. Chem. Phys.*, **6**, 908; 1938) found a spin of $\frac{1}{2}$ and that $^{15}N$ nuclei obey Fermi-Dirac statistics by examining the bands of $^{15}N$—$^{15}N$ produced from ammonia containing approximately 36 per cent $^{15}N$. Generally the bands are confused with those of $^{14}N$—$^{14}N$ and $^{14}N$—$^{15}N$, but the $1 \rightarrow 0$ band of the negative band ($N_2^+$) is an exception having its head at 3582·3 A. for $^{14}N$—$^{14}N$, 3587·4 A. for $^{14}N$—$^{15}N$, and 3592·5 A. for $^{15}N$—$^{15}N$. In this last band the *P* branch is free from overlapping by other bands and, on resolution with a 21-foot grating with 30,000 lines per inch and a dispersion of 0·6 A. per mm., exhibits alternating intensities of successive lines, the odd-numbered lines being strong. C. E. Miller (*ibid.*, **6**, 902; 1938) found that it was impossible to obtain a value for the spin of $^{15}N$ from the rotational Raman spectrum of $N_2$, although he obtained good spectrograms from it at four atmospheres with a 20-hour exposure. The difficulty arose from the fact the spectrum contained a very large number of lines due to the three isotopic analogues, $^{14}N$—$^{14}N$, $^{14}N$—$^{15}N$, and $^{15}N$—$^{15}N$. He was, however, able to obtain all the rotational lines from $J = 2$ to 18, and his values are in good agreement with those calculated from theory. The $0 \rightarrow 1$ vibration frequency of nitrogen is 2328·3 cm.$^{-1}$.

# Science Masters' Association

## Annual Meeting

THE thirty-ninth annual meeting of the Science Masters' Association was held in Cambridge on January 3–6, under the presidency of Prof. James Gray.

The presidential address—"The Role of Science in Education"—was delivered to about five hundred members. Prof. Gray recalled that at the last meeting Sir Richard Gregory gave a challenge to all those engaged in the teaching of science. In his address Sir Richard said, "Undergraduates are led to believe that their studies in any particular branch of science unfit them for any occupation other than those of teacher, research worker, or technologist in that branch." Prof. Gray maintained this was a challenge which neither the schools nor the universities could ignore. Early in life a boy had to choose the course of his future studies, whether he would follow a literary, a linguistic or a scientific road. Sir Richard Gregory had pointed out that a very small proportion of our administrators are recruited from those travelling along the scientific road because it is alleged that such a path provides an unsatisfactory medium of general education, while administrative ability and an aptitude for science are mutually exclusive. Prof. Gray said that many claims have been made for a scientific education, but they fail to stand up to critical examination. Although the door of the Civil Service is open equally to those trained in any subject, men with a scientific training rarely enter because they are found inadequate as men of the world.

Men of science have long claimed that a scientific education is necessary for life in the modern world, but further investigation has shown that this cold detached attitude is not that required by those having intercourse with the ordinary man. Further, when we claim excellence in observational faculties, investigations suggested that our observation is too limited and specialized, whereas our literary, legal and classical colleagues are better able to detect the solution of human problems: the main difference between the two types of education lies in the attitude towards moral values. The scientist bases his training on a moral code far simpler than that which is deemed adequate for other walks of life. As Sir Richard Gregory said, "Science as such is not concerned with moral values which in the long run determine the policy of the statesman; science is concerned with truth." Men of science may feel glad that this is so, but it may tend to widen rather than bridge the gap between us and our literary friends.

The amazing growth of the Association indicates that, could it but speak with one voice, it could achieve much. If science teachers are to give the best preparation for life to their students, they must give them width of vision and depth of insight, which link together into a natural unity the fields at present separated by unscalable walls. Is it not therefore desirable to bring about a much closer correlation between our scientific training and the matter dealt with on the literary, linguistic and historical sides of school and university? Could not science be less specialized and held together with other studies by an intellectual cement? One of the greatest barriers to the widened curriculum is the present examination system. But surely, if the Science Masters' Association would state unequivocally what it considers should be the content of examination and other syllabuses faithfully reflecting the teaching which in its opinion is most appropriate, the labour would be well spent.

An interesting lecture, "Terrestrial Magnetism and the Sunspot Cycle" was delivered by Prof. E. V. Appleton. He dealt with the results of observations on the variations of the magnetic elements and their relation to the sunspot cycle. He showed how the explanation of this interrelation, first suggested by Dr. Balfour Stewart, is supported by recent observation.

In a talk on "Arctic and Antarctic Seals and Sealing", Mr. G. C. L. Bertram explained the different species of seals and how the exploitation of two species is scientifically controlled. Other species are virtually extinct due to irrational exploitation and are woeful examples of man's lack of foresight.

Prof. R. G. W. Norrish, lecturing on "Experiments in Photo-Chemistry", delighted a very large audience by the display of a number of spectacular and convincing experiments.

In his lecture, "X-Ray Optics", Prof. W. L. Bragg explained some recent advances in the technique of determining crystal structures. He dealt with the modern method of synthesizing an image, from the experimental measurements of scattering, of the atoms in a crystal, the final pattern having a magnification of $10^8$.

A lecture, "Some Aspects of Geology", by Prof. O. T. Jones aroused interest in a subject which is being more generally recognized to-day in the schools than it has been hitherto. The importance of the subject, particularly on the applied side, was stressed.

Many delightful slides in a lecture of general interest delivered by Dr. H. B. Cott interested a mixed group. This dealt with "Camouflage in Nature and in War". Dr. Cott explained various methods of camouflage adopted by animals for concealment and showed how every scheme of applied camouflage must be based upon the effects employed by animals.

At an open meeting, Mr. N. E. Odell, who has just returned from the 1938 Everest Expedition, gave a graphic description of the events of this last attempt on Everest. He showed how the exceptionally bad weather conditions, in spite of all efforts, prevented the summit being reached.

Mr. H. E. Dance and Mr. J. W. Cottingham opened a film discussion on "Films in the Science Classroom". The opening talks were followed by lively discussion.

The headquarters of the meeting were in the new building of the Department of Zoology. Here were housed exhibitions of books by various publishers and of scientific apparatus by instrument makers. The programme included visits to laboratories and works in the district. Demonstrations were arranged by the science departments of the University.

Lord Horder was elected president for 1939.

# Scientific and Industrial Research in New Zealand

THE twelfth annual report of the Department of Scientific and Industrial Research, New Zealand, includes the Minister's statement, together with the Secretary's report, and the reports of the various research committees, institutes or bureaux under the Council. Some account of research work at Canterbury Agricultural College is included, and also of the work of the Geological Survey Branch, the Meteorological Branch, the Dominion Observatory and the Apia and Magnetic Observatories. Referring to the work of the Meteorological Branch, the Minister emphasizes its growing importance as a result of the rapid expansion of commercial aviation within New Zealand and the development of trans-oceanic aircraft. The Geological Survey Branch has gained importance through the Government's proposals in regard to the establishment of an iron and steel industry, and also through the recent activity of oil prospecting, with its emphasis on the importance of accurate data on geological structure and mineral resources of the Dominion. During the year, the Soils Survey Division of the Department has carried out an extensive programme of work in Hawke's Bay, North Auckland, Blenheim, West Coast and Bank's Peninsula, the results of which are being published. The Soils Survey Division has also contributed important data collected in the course of soil surveys which bear on the problem of soil erosion and land deterioration in New Zealand.

These activities fall under the broad section of the activities of the Department which is concerned with provision of essential scientific services to the Government. In this section is also included the work of the Dominion Laboratory, which has recently carried out much work for the Housing Department in connexion with the examination of a wide range of building materials, and has given valuable advice as to the durability and general standard of the materials used. The laboratory is also carrying out important industrial research work, particularly in relation to the phormium, kauri gum and fruit industries, and has almost completed an investigation of the curing of lemons, which has given results of real value to the industry. The work of the Plant Research Bureau has been further consolidated and is now a major branch of the Department's activity. The Botany Section (now established in Wellington) has been engaged in two major investigations which have a bearing on economic problems—ragwort and South Island tussock grasslands. These studies have revealed the remarkable capacity of the ragwort to regenerate from root fragments, and have indicated that toxic sprays seldom injure the plant to such an extent that regeneration of roots will not occur. The Entomological Division has largely centred on measures designed to control the two principal insect pests of rape and turnip crops and has undertaken a study of insect pests of wheat. Work has also been completed on the effect of Agrosan and Ceresan dusts on the seed of wheat, oats, barley and peas, and has shown that little or no adverse effects can be detected on the treated seeds when stored for periods less than five months, either in subsequent germination or in the control of disease. The Plant Diseases Division has made good progress with spray testing technique, and with the growing of pyrethrum. Attention has also been devoted to problems of industrial mycology.

The Dairy Research Institute has been responsible for important advances in the study of the technique for the maintenance of single strain starters, and in this connexion the experience of the Institute has emphasized the importance of the technical education of managing foremen in industrial efficiency. New research associations have been established to provide a co-ordinated scientific and technical service for the woollen manufacturing, boot and shoe manufacturing and tobacco industries. The newly-formed Social Science Research Bureau has directed its activities to a study of the standard of living of dairy farmers. The study of dietary requirements has been handed over to the Medical Research Council, at a stage where family diets have been formulated giving sufficient energy and protective food values. The report also includes accounts of the work of the Wheat Research Institute, of the Fruit Research and Radio Research, as well as of the work of the Standards Institute.

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# Protection of the Natives of Dutch New Guinea

MEN of science in Holland have been by no means blind to the havoc which is being caused, especially among fauna and flora, by Western exploitation of natural resources in the remoter parts of the world. They also appreciate to the full the deleterious effects of the impact of Western civilization on primitive peoples. This latter problem is one which has been brought home to them with peculiar force and urgency, not only on behalf of the native populations under Dutch administration in Indonesia, but also owing to the prospective rapid development of the natural resources of Dutch New Guinea in the near future, where the use of aeroplanes by the great oil interests and also prospecting for minerals are bringing about the speedy opening up of the hitherto inaccessible interior.

On April 29, 1937, the Netherlands Committee for International Nature Protection, an influential body which came into being, as its name implies, for promoting international co-operation in devising measures for preventing or alleviating the grosser and more harmful results in Nature of the spread of civilization

appointed a sub-committee to consider measures for the protection of the natives of Dutch New Guinea. This sub-committee was composed of members eminent in science, or with experience of primitive peoples and of industrial organization in the tropics. Among them were Prof. O. de Vries, of the Government Agricultural Experimental Station at Groningen, Dr. A. J. M. van W. van der Gracht, of the Government Service for the Supervision of Mines, and Dr. H. J. T. Bijlmer, whose expedition to the mountain region of Dutch New Guinea in 1936 effected contacts with native peoples who had never previously seen a white man. The sub-committee has prepared a report, which has been adopted by the main committee and has recently been submitted for consideration to the Governor-General of the Dutch Indies and the Minister for the Colonies*.

The native problem, it is pointed out by the Committee in its report, is twofold. The population of the coastal lands, which on broad lines is already known geographically, consists of tribes of Papuan stock, which already have been in contact with Europeans, official, mission and other, for some decades. These tribes are fierce and warlike, cannibals and head-hunters, among whom murder and manslaughter are rife. Some of them are still uninfluenced by civilization. In the mountain region, until recently almost entirely unexplored, on the other hand, the inhabitants are Papuans of a specialized type, some indeed of so low a stature as almost to warrant the designation of pygmies. Of these a few only had been reached in recent years by scientific expeditions, and that with extreme difficulty, before the aeroplane made the country more readily accessible. The culture of these mountain peoples is of a different order from that of the peoples of the coastal lands. They cultivate gardens and keep pigs, are industrious, and have settled habitations, while their warfare is of a mild type. In disposition they are friendly, and greet European contacts in an amicable spirit.

Two alternative methods of dealing with the native problem presented themselves to the Committee for consideration. Of these the first was the complete segregation of the native population from all contacts with civilization in a native reserve, in which they might be preserved with their culture as museum specimens. The second alternative was the protection of the native population from the effects of a full and sudden impact of white civilization—the abruptness of the impact constituting, it was felt, the essential danger—by a process of gradual preparation and education, in which contact with European influence would be subject to stringent and careful regulation.

The Committee elected in favour of the latter course as the more practical, and at the same time the more fair to the native, as it would leave open to him the possibility of cultural development, from which, it was felt, he should not be debarred, as he would be under the first alternative.

It is, therefore, suggested that provision should be made for three stages of development and contact: (1) a period of gradual reconnoitring and penetration, research and study, with a minimum of native control by Government agencies; (2) a period of gradual building up of a new culture, the introduction of missions and mission schools, the intensification of Government functions, with a recognition of native authorities, and the extension of communications, and other forms of economic development; and (3) the normal colonial condition of Dutch administration, with co-operation with, and recognition of, local native autonomy.

In order to bring about the smooth development of these three stages of progress, certain regulations are suggested, which include the declaration of population reserves, in which in addition to the existing regulations as to permits for entrance, no Eastern immigrants should be admitted, and no corporate or individual enterprise should be allowed except under special conditions framed to protect the interests of the natives. As a condition of admission to New Guinea, medical examination and precaution against infectious or other disease should be added to the requirement of a permit; the importation of all alcohol and drugs should be prohibited; and the importation and sale of drapery goods should also be prohibited in order to enforce the wearing of the native type of clothing. Further, the establishment of estates should be subject to regulation, ensuring the preservation of sufficient agricultural land for the needs of the native population, while the importation of labour and recruiting of indigenous labour should be regulated. A large area of the mountain region should be declared a reserve, though not debarred to prospecting, which being for the most part of a transient character should not, under permit, affect the interests of the native population. This large reserve, when known ethnologically, and technically explored, might be broken up into smaller units.

It will be seen that the Committee, in framing its recommendations, has wisely aimed at reconciling the efficient protection of the interests of the indigenous population with the opening up and commercial development of this valuable territory. In framing its policy it has been, as is duly acknowledged, much indebted to the measures taken by the Australian Government for the administration of the Mandated Territory of New Guinea, and above all to the conceptions in native administration of Governor General Sir Hubert Murray.

* Netherlands Committee for International Nature Protection: Report concerning the Possibility of Protecting the Primitive Natives, especially the Mountain—Papuan—Tribes in Dutch New Guinea. Pp. 32. (Amsterdam: Nederlandsche Commissie voor Internationale Natuurbescherming.)

## University Events

BELFAST.—The title of professor emeritus has been conferred on Prof. F. Hummel, who retired recently from the chair of civil engineering.

EDINBURGH.—On January 11, Sir William Bragg formally opened the new common room of the University, situated at King's Buildings, West Mains Road. It is designed to meet the physical and social needs of the students of science, most of whose work is done at King's Buildings. During the ceremony, it was announced that Dr. J. A. Thomson had given £5,000 and promised up to £10,000 towards the maintenance of the building.

Sir William Bragg also took the chair at the inaugural lecture of the newly instituted lectureship of crystallography. The lectureship was founded by a fund left by Lady Dewar, widow of Sir James Dewar, in 1936, and the lecture was delivered by Dr. C. A. Beevers, Dewar research fellow.

## Science News a Century Ago

### Schools of Engineering, Mining and Surveying

"As very great ignorance seems to exist among the would-be political economists as to the state and progress of the schools for engineering, mining and surveying, we are induced to publish the following remarks :—The Government have the departments at Sandhurst, Woolwich and Chatham ; the East India Company have also a college ; the Royal Dublin Society have long given regular courses of lectures and instruction, under the superintendence of Mr. Griffiths ; and surveying has been so effectively taught at the Agricultural School of Templemoyle, that the Ordnance Survey Department there has received considerable assistance from it. Surveying is one of the regular branches of instruction at Elizabeth College, Guernsey, and we believe also at King William College in the Isle of Man.

"But if any deficiency of these institutions exists it will be fully supplied by the facilities established at Durham and in University and King's College, London. . . ." (*Civil Engineer and Architects' Journal*, Jan. 1839).

### Statistics Applied to Medicine

BEFORE the Statistical Society on January 23, 1839, a paper was read by Dr. Guy, professor in forensic medicine, King's College, London, entitled On the Value of the Numerical Method as applied to Science, but especially to Physiology and Medicine".

"The success," said the author, "with which calculation has been applied to unorganized matter, and the confidence with which the natural philosopher resorts to it on all occasions, have not failed to exert a powerful influence on those who pursue the study of organized beings, and a growing disposition to apply calculation to the phenomena of life is one of the characteristics of the age in which we live." Having referred to the application of statistics to insurance, crime, bills of mortality, etc., he went on to say that "it often happens that an event is attributed to a cause which varies in intensity under different circumstances or in different localities, and we have no other means of testing the accuracy of our opinion than by comparing the frequency of the event in question, with the varying influence of the assumed cause ; and should the same numbers be obtained in every case we are justified in rejecting that cause. If this rule be applied to the received opinions on the subject of phthisis pulmonalis, we should soon see how void they are".

Dr. William Augustus Guy (1810–1885), the author of this paper, edited the *Journal of the Statistical Society* from 1852 until 1856 and served as president of the Society during 1873–75. He was a vice-president of the Royal Society and a founder of the Health of Towns Association.

### Geology of Portugal

ON January 23, 1839, Daniel Sharpe (1806–56), a business man who had resided in Portugal, read a paper to the Geological Society "On the Neighbourhood of Lisbon". "In few countries," he said, "can the separation between the tertiary and secondary formations be more strongly marked than in the neighbourhood of Lisbon. The rocks of the latter class were distributed and denuded before the commencement of the tertiary epoch, and a vast mass of basalt, covering an extensive district to the west and north of Lisbon, is interposed between the youngest of the secondary and the oldest of the tertiary strata". "The 'Hippurite' limestone," he said, "consists in the upper and middle parts of marls and argillaceous limestones, containing layers of flint, and in the lowest of a beautiful hard marble. It occurs only on the Lisbon side of the Tagus." The 'Espichel' limestone is composed of shale and grey limestone. It constitutes the Cape after which it is named."

Sharpe at the time of his death was president of the Geological Society.

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## Societies and Academies

### Edinburgh

**Royal Society of Edinburgh, January 9.**

F. I. G. RAWLINS : Physical methods in the investigation of paintings (address). A painting, considered scientifically, is an essentially stratified structure, consisting of the support (stone, wood or canvas), the ground (gesso or priming), the paint-film, and the varnish film. These layers may themselves be complex, and they are rarely independent as regards forces of binding, expansion and contraction. Methods of investigation, therefore, have been developed akin to those which have proved valuable in petrology, surface-chemistry and crystal structure. The chief aims of a picture laboratory are (*a*) the study of condition, (*b*) study of technique of pure examples of the chief schools. X-rays, ultra-violet and infra-red rays are all of use. Also microscopy, with polarized light, is employed.

K. FUCHS : Invariance of quantized field equations. It is proved that the theory of quantum dynamics as developed by Heisenberg and Pauli is invariant not only against Lorentz transformations but also against all transformations allowed by the general theory of relativity. Although it is impracticable to write the quantized Hamiltonian equations and the quantum conditions in tensor form (the canonically conjugate variables do not form a tensor), it can be shown that the complete system of field equations plus commutation relations does not depend on the co-ordinate system.

### Paris

**Academy of Sciences (*C.R.*, 207, 1341–1456, Dec. 27, 1938).**

H. DESLANDRES : Application to some interesting molecules of the new analysis of molecular spectra.

H. COLIN and M. SIMON : Nitrogen, organates and saccharin richness of the sugar-beet.

F. GRANDJEAN : Neoteny (presence of immature characters in the adult) in the Acarids.

G. GIRAUD : A new extension of the theory of elliptic equations.

J. HAAG : A biharmonic problem.

D. RIABOUCHINSKY : Interpretation of theoretical movements of fluids by 'animated' diagrams.

G. DENIGÈS : Very sensitive micro-crystalline reactions of bismuth and antimony metalloids.

L. DANIEL : Two new cases of xenia in the apple-tree.

H. DAVENPORT : Sums of integral powers.

P. LÉVY : Properties of some indefinitely divisible laws.

P. HEBRONI : Continued two-term matrices and their application to linear integro-differential equations.

J. DELSARTE : Continuous hypercomplex systems and the theory of multi-groups.

L. KANTOROVITCH and A. PINSKER : Partially additive functions in semi-ordered spaces.

L. HIBBERT : The system (R.V.) of integral functions about the essential singular point.

P. DIVE : Barotropic [surfaces of equal pressure and equal density coincident] rotations in the second approximation in a fluid star stratified in ellipsoidal layers.

D. BELORIZKY : Singular points in the limited problem of three bodies.

L. NÉEL : Application to nickel of a new method of measuring the true specific heat.

W. UYTERHOEVEN and C. VERBURG : Temperature of electrons $T_e$ in a positive column discharge with alternating current (50 ~ ); experimental method.

MLLE. S. VEIL : Silver-platinum comparisons in aqueous solutions of iodides, and electrostatics of the contact $Ag–I^-$.

R. FORRER : Decomposition of the elementary moment of ferromagnetics, and the gyromagnetic phenomena.

A. DAUVILLIER : Identification of Hoffmann collisions with electron bundles produced by cosmic rays.

T. KIU : Remarks on the curves of blackening on [photographic] plates in the region of under-exposure.

G. LIANDRAT : Two different examples of the non-additivity of the photo-electric effects of simultaneous luminous fluxes.

C. BENEDICKS : Diagram permitting the graphical representation of the composition of multiple systems, such as those of the light alloys.

A. MAMAN : Contribution to the study of the octanes.

E. LUCATU : Relation between vapour pressure, viscosity and molecular association.

R. VAILLARD : Inflammation of gaseous mixtures by the electric spark : air—diethylether mixtures.

R. LUCAS : Mechanism of fusion.

J. BÉNARD and G. CHAUDRON : Solid solutions of the cubic sesqui-oxide of iron obtained by oxidation of substituted magnetites.

A. PORTEVIN and H. JOLIVET : A mode of decomposition of austenite.

MLLE. D. BIQUARD : Raman spectra of *cis* and *trans* α and β decalones.

MME. P. RAMART-LUCAS : Structure of rhodamines from their absorption spectra.

P. CHOVIN : Researches on the Pechmann colouring matters : scission reactions in the symmetric dinaphthylated series.

R. PAJEAU : Influence of bromides of beryllium, magnesium, zinc and cadmium on the bromination of benzene. They show catalytic activity increasing with atomic weight of the metal, excepting beryllium.

L. DUBERTRET : The Oligocene and the Burdigalian in Syria.

R. FURON and P. LEMOINE : Presence of the nummulitic at Pondicherry (French India).

L. BERTRAND : Triasic terrains of the middle part of the Département du Var.

F. BLANCHET : Tectonics of the left bank of the River Durance in the neighbourhood of La-Roche-de-Rame (Hautes-Alpes) and its relations with the Guil nappes.

B. RAJČEVIĆ : The regime of the sands of the estuary of the Seine.

C. DAUZÈRE : Lightning strokes in the Département de la Haute-Garonne. Frequency of lightning strokes is related to the nature of the soil.

R. GRANDMONTAGNE : Decrease of blue and red light at the end of twilight. Photo-electric measurements show that the red radiation decreases to constant intensity earlier than the blue radiation.

J. MAGROU and J. BOUGET : Presence of mycorrhiza in potatoes reverted to the wild state.

M. BREISTROFFER : An umbellifer hitherto not known in the French flora, *Scandicium stellatum* Thell. of the Baronnies (Hautes-Alpes).

R. FRANQUET : Inulin in grafts of annual sunflowers and of perennial Composites.

P. CHOUARD and P. VAIDIE : Distinct action of photoperiodism on the formation of buds and the development of flowers in the chrysanthemum.

MME. S. LALLEMAND : Experimental production, with the aid of colchicine, of strophosomous chicks [with exposed thoracic and abdominal organs, tail applied at the head, etc.].

J. ESCHER-DESRIVIÈRES, E. LEDERER and MLLE. M.-L. VERRIER. Researches on the retinal pigments of Cephalopods.

MME. V. DANTCHAKOFF : Folliculin in the sexual histogenesis of the embryo of mammals.

J.-H. VIVIEN : Effects of hypophysectomy in a marine teleostean, *Gobius paganellus* L.

## Tokyo

Imperial Academy (*Proc.*, **14**, No. 8, October 1938).

TSURUSABURO TAKASU : A conformal geometric generalization of geodetic lines.

TATSUO KAWATA : Remarks on the representation of entire functions of exponential type.

TAKESHI INAGAKI : Remark concerning a problem of M. N. Lusin.

MASAO INOUE : The stability of Dirichlet's problem.

KENJIRO SHODA : (1) Equivalence of representation of finite groups through semi-linear transformations. (2) Invariants of finite groups of half-linear transformations.

KÔSAKU YOSIDA : (1) Abstract integral equations and the homogeneous stochastic process. (2) Mean ergodic theorem in Banach spaces.

SHIZUO KAKUTANI : Iteration of linear operations in complex Banach spaces.

RYOJI SAKATA : Representation of compactness of a sphere.

SABURO NAKANO : Harmonic analysis of nineteen years material of latitude variations observed at some international latitude stations.

KEN SUGAWARA : Dichotomous microstratification of *p*H. A new type of dichotomous stratification of *p*H developed in the epilimnion of Takasuka-Numa.

YOSHIKAZU TOYOHARA : Inclination of the strand along a sandy seashore (1).

## Forthcoming Events

[*Meetings marked with an asterisk are open to the public.*]

### Monday, January 23

UNIVERSITY OF LEEDS, at 5.15.—Prof. R. A. Peters, F.R.S.: "Some Aspects of Vitamin $B_1$ and Brain Biochemistry".*

UNIVERSITY COLLEGE, LONDON, at 5.30.—Dr. H. S. W. Massey: "The Quantum Theory and Modern Physical Science".*

### Wednesday, January 25

COURTAULD INSTITUTE OF ART, at 5.30.—Prof. W. Perceval Yetts: "Astronomy in Chinese Art".*

### Thursday, January 26

ROYAL SOCIETY, at 4.30.—W. J. C. Lawrence, J. R. Price, Sir Robert Robinson, F.R.S. and Lady Robinson: "The Distribution of Anthocyanins in Flowers, Fruits and Leaves".

### Friday, January 27

PHYSICAL SOCIETY AND ASTRONOMICAL SOCIETY (Joint Meeting), at 5.15.—Discussion on "The Expanding Universe", to be opened by Prof. G. F. J. Temple and Dr. G. C. McVittie.

ROYAL INSTITUTION, at 9.—Prof. J. D. Bernal, F.R.S.: "Structure of Proteins".

## Appointments Vacant

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:

LECTURER IN ELECTRICAL AND MECHANICAL ENGINEERING in Shrewsbury Technical College—The Clerk to the Committee of Management, County Buildings, Shrewsbury (January 23).

ASSISTANT LECTURER IN BACTERIOLOGY in the West of Scotland Agricultural College, Glasgow—The Secretary (February 1).

TEACHER OF MINING in Doncaster Technical College—The Secretary, Education Offices, Doncaster (February 8).

ASSISTANT LECTURER IN MECHANICAL ENGINEERING in the Manchester Municipal College of Technology—The Principal (February 6).

GUIDE-LECTURER (woman) in Leicester Museum—The Director (February 14).

## Reports and other Publications

(*not included in the monthly Books Supplement*)

### Great Britain and Ireland

Nutrition and Local Government—What your Local Authority can Do. By Marjorie E. Green. Pp. 20. (London: Children's Minimum Council.) 3*d*. [1512

The Air Almanac, 1939, January–March. Prepared by H.M. Nautical Almanac Office on behalf of the Air Ministry. (Air Publication 1602.) Pp. 188+xii. (London: H.M. Stationery Office.) 5*s*. net. [1512

Imperial Forestry Institute: University of Oxford. Fourteenth Annual Report, 1937–38. Pp. 36. (Oxford: Imperial Forestry Institute.) [1912

Amgueddfa Genedlaethol Cymru: National Museum of Wales. Thirty-first Annual Report, 1937–38. Pp. 52. (Cardiff: National Museum of Wales.) [1912

Department of Scientific and Industrial Research. Report of the Fuel Research Board for the Year ended 31st March 1938, with Report of the Director of Fuel Research. Pp. x+255. (London: H.M. Stationery Office.) 4*s*. net. [1912

Manchester Museum: University of Manchester. Museum Publication No. 115: Report of the Museum Committee for the Year 1937–38. Pp. 31. (Manchester: Manchester Museum.) 6*d*. net. [1912

Leeds University. Report to the Worshipful Company of Clothworkers of the City of London of the Advisory Committee on the Departments of Textile Industries and Colour Chemistry and Dyeing, during the Session 1937–38. Pp. 24. (Leeds: Leeds University.) [1912

John Innes Horticultural Institution. Twenty-eighth Annual Report for the Year 1937. Pp. 28. (London: John Innes Horticultural Institution.) [2012

National Physical Laboratory. Tests and Measurements undertaken by the Physics Department, Acoustics Division. Pp. iii+28. Tests and Measurements undertaken by the Physics Department, Heat Division. Pp. iii+56. Tests and Measurements undertaken by the Physics Department, Radiology Division. Pp. iii+23. (Teddington: National Physical Laboratory.) [2012

Hull Museum. Publication No. 87: Illustrated Catalogue of the Museum of Fisheries and Shipping. By Thomas Sheppard. Eighth edition. Pp. 88. 6*d*. Publication No. 186: Wilberforce House, Hull. By T. Sheppard. Second edition. Pp. 24. 2*d*. Publication No. 197: Excavations at Eastburn, East Yorkshire. By Thomas Sheppard. Pp. 15+6 plates. Publication No. 198: A Roman and Saxon Site at Elmswell, East Yorks, 1937. By Anthony L. Congreve. Pp. 42+2 plates. (Hull: Hull Museum.) [2012

Twenty-ninth Report of the Commissioners of His Majesty's Customs and Excise for the Year ended 31st March 1938: Being the 82nd Report relating to the Customs and the 81st Report relating to the Excise. (Cmd. 5876.) Pp. 215. (London: H.M. Stationery Office.) 3*s*. 6*d*. net. [2212

Department of Scientific and Industrial Research. Index to the Literature of Food Investigation. Vol. 10, No. 2, September 1938. Compiled by Agnes Elisabeth Glennie, assisted by Gwen Davies and Catherine Robson. Pp. v+95–187. (London: H.M. Stationery Office.) 4*s*. 6*d*. net. [2212

### Other Countries

Osiris. Vol. 4. Part 2: Science, Technology and Society in Seventeenth Century England. By Robert K. Merton. Pp. 360–632. (Bruges: St. Catherine Press, Ltd.) [1912

Crohamhurst Observatory. Observatory Paper 9: The Climate of Australia during the Hypothetical Jovian Sunspot Cycle 1913–1924 together with the Monthly and Annual Rainfall Observations at Selected Stations during that Period, and some Comments on the Evidences of Cyclical Reproduction of the Weather. By Inigo Jones. Pp. 111. (Crohamhurst: Crohamhurst Observatory.) [1912

Commonwealth of Australia: Council for Scientific and Industrial Research. Bulletin No. 121: Observations on the Toxicity of Fluorine for Sheep. By A. W. Peirce. Pp. 35+6 plates. (Melbourne: Government Printer.) [1912

Geological Survey of British Guiana. Bulletin No. 11: Report on the Geology of the Superficial and Coastal Deposits of British Guiana. By Dr. D. R. Grantham and R. F. Noël-Paton. Pp. 122. (Georgetown: Geological Survey of British Guiana.) 1 dollar. [1912

Carnegie Institution of Washington. Annual Report of the Director of the Department of Terrestrial Magnetism. Pp. iii+62. (Washington, D.C.: Carnegie Institution.) [1912

An Introduction to the Study of Air Mass Analysis, by Jerome Namias; and Characteristic Properties of North American Air Masses, by Prof. Hurd C. Willett; also The Norwegian Wave-Theory of Cyclones, by B. Haurowitz; and Notes, Bibliography and Illustrations. Fourth edition, enlarged and revised. Pp. iv+122. (Milton, Mass.: American Meteorological Society.) 75 cents. [1912

Journal of the Indian Institute of Science. Vol. 21A, Part 32: Dissociation Constants of *Cis* and *Trans* Caronic and Norpinic Acids. By C. T. Abichandani and S. K. K. Jatkar. Pp. 373–384. 1 rupee. Vol. 21A, Part 33: Studies in Binary Systems. Part 2: Heats of Adsorption from Binary Mixtures of Toluene and Acetic Acid by Charcoal and Silica Gel. By J. G. Kane and S. K. K. Jatkar. Pp. 385–394. 14 annas. Vol. 21A, Part 34: Detergent Action of Soaps. Part 1: Interfacial Tensions of Pure Soap Solutions. By B. S. Kulkani and S. K. K. Jatkar. Pp. 395–406. 14 annas. Vol. 21A, Part 35: Studies in Binary Systems. Part 3: Adsorption and Heats of Adsorption from Binary Mixtures of Methyl Alcohol—Water by Active Charcoal and Silica Gel. By J. G. Kane and S. K. K. Jatkar. Pp. 407–412. 10 annas. Vol. 21A, Part 36: Studies in Binary Systems. Part 4: Adsorption from Mixtures of Toluene and Acetic Acid by Deashed Animal Charcoal. By J. G. Kane and S.K.K. Jatkar. Pp. 413–416. 8 annas. (Bangalore: Indian Institute of Science.) [2012

Advisory Committee on Education. Staff Study No. 7: Selected Legal Problems in providing Federal Aid for Education. By Robert R. Hamilton. Pp. ix+71. (Washington, D.C.: Carnegie Institution.) 15 cents. [2212

Carnegie Corporation of New York. Report of the President and of the Treasurer for the Year ended September 30, 1938. Pp. 158. (New York: Carnegie Corporation of New York.) [2212

Seventy-five Years: a History of the Buffalo Society of Natural Sciences, 1861–1936. (Vol. 18 of the Bulletin.) Pp. 204+53 plates. (Buffalo, N.Y.: Buffalo Society of Natural Sciences.) [2212

Meddelelser om Grønland udgivne af Kommissionen for Videnskabelige Undersøgelser i Grønland. Bind 82, Nr. 5: The Godthaab Expedition 1928—The Phytoplankton of the Waters West of Greenland. By Jul. Grøntved and Gunnar Seidenfaden. Pp. 380+2 plates. 18.00 kr. Bind 96, Nr. 6: Geologisk Ekspedition til Østgrønland 1936–38—Middle Devonian Vertebrates from Canning Land and Wegener Peninsula (East Greenland). Part 1: Placodermal Ichthyodorulithes. By E. Asson Stensiö and G. Säve-Söderbergh. Pp. 38+14 plates. 3.50 kr. Bind 100, Nr. 7: Treaarsexpeditionen til Christian den X's Land 1931–34—The Biology of some Important Plankton Animals in the Fjords of East Greenland. By Hans H. Ussing. Pp. 108. 5.00 kr. Bind 103, Nr. 4: Treaarsexpeditionen til Christian den X's Land 1931–34—Sedimentpetrographische Untersuchungen in Ost-Groenland: Petrographie, Granulometrie und Abrollung rezenter Sande aus Christian X Land. Von Armin Von Moos. Pp. 76. 3.25 kr. Bind 103, Nr. 5: Treaarsexpeditionen til Christian den X's Land 1931–34—Die tektonischen Strukturelemente des östlichen Moschusochsenfjordes. Von H. Bütler. Pp. 8. 0.25 kr. Bind 109, Nr. 1: 6 og 7 Thule-Expedition til Sydøstgrønland 1931–33—Knud Rasmussen's Posthumous Notes on the Life and Doings of the East Greenlanders in Olden Times. Edited by H. Ostermann. Pp. 215. 10.00 kr. Bind 112, Nr. 4: Treaarsexpeditionen til Christian den X's Land 1931–34—Skelettreste von *Dicrostonyx groenlandicus* Traill als inhalt von Raubvogelgewöllen. Von E. v. Mandach. Pp. 54+22 plates. 5.00 kr. Bind 119, Nr. 7: Weberite, a New Mineral from Ivigtut. By Richard Bøgvad. Pp. 12+1 plate. 0.54 kr. Bind 119, Nr. 8: Archæological Investigations in Knud Rasmussen's Land. By Helge Larsen. Pp. 78+3 plates. 4.00 kr. Bind 121, Nr. 2: The Zoology of East Greenland—Collembola. By Marie Hammer. Pp. 42. 2.00 kr. (København: C. A. Reitzels Forlag.) [2212